MODEL AIRPLANE NEWS

57 MIDSIZE TRAINERS COMPARED

THE WORLD'S PREMIER R/C MODELING MAGAZINE

December 1994

SEE WHO WON
—page 40

CARL GOLDBERG Sukhoi

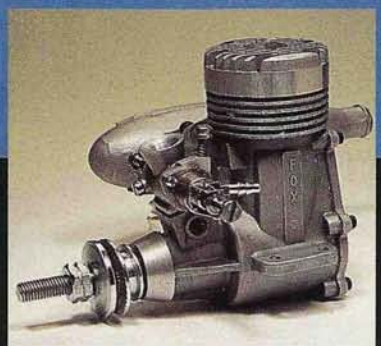
ULTI-NGINE ECHNIQUES

UILD A STAND-FF GEE BEE

EPAIR OAM-CORE VINGS

- **GLENN TORRANCE Fokker Dr.I**
- **CANNON Ultra-Micro System**
- **STREAM INC. Schneider Sport 60-E**

ONUS! GET STARTED



BUYERS' GUIDE

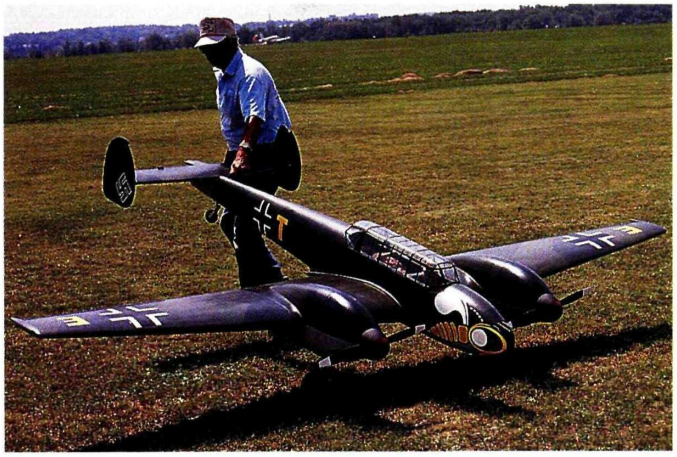
USA $3.50 CANADA $4.50

12>
UPC
0 09128 48120 3

DECEMBER 1994 VOLUME 122, NUMBER 12

MODEL AIRPLANE NEWS

FEATURES



ABOVE: *Mac Smith of Johnstown, NY, with his Messerschmitt Bf 110 Zerstörer in tow at the 7th Annual Giant Warbirds Festival.*

ON THE COVER: *center—Ron Faanes' Carl Goldberg Models SU-26 is caught in mid-flight by staff photographer Walter Sidas. Trainers shown in insets, left to right: Thunder Tiger's Tiger Trainer 40 ARF, Royal Product's Royal-Air 40T MKII and Hobby Lobby's Telemaster 40 (see "Buyers' Guide" and "Midsize Trainer Guide" summary). Bottom, left to right: Hitec Focus 4FM, Fox 40BB RC engine and the Futaba SkySport 6VA.*

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

lodel Airplane News (ISSN 0026-7295) is published monthly by **Air Age, Inc.**, 251 Danbury Rd., Wilton, CT 06897. Second-class postage paid at Wilton, CT, and at additional mailing offices. Subscription rates: $27.95 for 1 ear (Canada, $43.82—includes G.S.T.; foreign, $40.95); $49.95 for 2 years (Canada, $81.27—includes G.S.T.; foreign, $75.95). **Postmaster:** send Form 3597 to **Model Airplane News,** P.O. Box 428, Mount Morris, IL 61054.

EDITORIAL

TOM ATWOOD

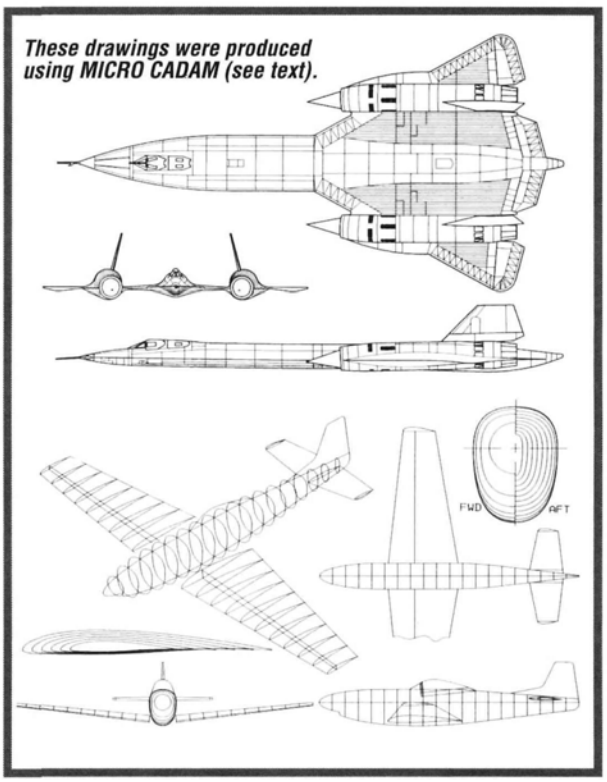
EMERGING MODELING SOFTWARE

Is it possible today to build and fly R/C aircraft without resorting to computers at some point along the way? Even if you don't own a PC, your R/C radio probably contains a computer chip. Computer-guided laser cutters are at work fashioning the parts of some of the kits we build. Computer numerically controlled (CNC) machines mill out engine parts and cut master plugs for mold castings. But what about computerized tools—software—that modelers can use directly?

There is an explosion of new software that can greatly benefit many modelers, particularly those interested in designing their own aircraft. Nearly everyone has heard about R/C flight simulators, such as the Dave Brown's R/C Flight Simulator and R/C Aerochopper, but the wealth of emerging software extends far beyond flight training. Available software includes computer-assisted design (CAD) systems for drafting plans, airfoil plotters with dozens of well-described airfoils, and tools for calculating model aircraft performance, to name only a few (see our next issue for a broad survey of software for modelers).

MICRO CADAM

An example of the value now coming to the hobby market is MICRO CADAM software. This is one of several CAD packages available to hobbyists (ModelCAD, reviewed in our July '92 issue, is another). To help expand CAD use among modelers, MICRO CADAM has been made available for the cost of its 1,100-page user manual ($51.95). CADAM is a workhorse CAD system typical of those used by major aircraft manufacturers such as Lockheed, Grumman, Boeing and Beech. MICRO CADAM is the IBM-PC version of mainframe CADAM. Its user interface and functions are identical to those of mainframe CADAM. This package is not the latest provided to full-scale aircraft engineers, but it contains all the basic design, drafting and analysis capabilities of CADAM—the same core capabilities as the mainframe version. Views can be scaled, rotated and moved without losing their mathematical relationship. For those with some familiarity with CAD systems, functions include: point, line, circle, spline, conic, analysis, group, detail, auxview, note, origin, dimension, type, corner, offset, relimit, symbol, window and show. As suggested by the illustration, MICRO CADAM's mathematically related views and spline and conic construction tools permit the drafting of fuselage and wing cross-sections and isometrics.



These drawings were produced using MICRO CADAM (see text).

For more information on this program, contact Dan Smyth of Silver Publishing, Box 71566, Aurora, Ontario, Canada, (905) 841-0253, or Jerry Dewit at (408) 438-5216 (refer to product number M-2). Your equipment must be at least a 386 PC and have a math coprocessor. A three-button mouse is recommended, although it isn't required. The software runs in 640K (no extra memory is required).

One of the great benefits of modeling is that the individual who has not received technical training in aeronautical engineering may nonetheless develop expertise in that area and experiment as a designer and engineer. Imagine such a person equipped with software for airfoil generation (say, a package that includes the SoarTech 8 compilation of wind-tunnel-tested model airfoils), as well as software for CAD drafting and a package that predicts aircraft performance. Would such a modeler be able to design original aircraft with something very close to the sophisticated analytic skills of highly trained aeronautical engineers? It's looking that way, and more so all the time. We'll keep you posted on the latest developments.

GETTING STARTED IN R/C?

If you're just getting started in R/C aeromodeling or know someone who is, take a look at the "Buyers' Guide" in this issue. There's a wealth of products represented there for those who are coming up the learning curve. We've also included a summary survey of trainers (see the trainer matrix) that offers a quick view of kits designed specifically for the novice R/C'er. Take a look, and see what's right for you or for that friend who's just getting started (after all, the holidays are just around the corner!).

FINAL APPROACH

In this issue, a new one-page column—"Final Approach"—debuts on the last page. Here, we will feature great R/C models and occasional guest essays on issues of importance to modeling. Do you have a piece in mind for that page? Let me know by writing to me, c/o Air Age Publishing, 251 Danbury Rd., Wilton, CT 06897; fax (203) 762-9803. ■

MODEL AIRPLANE NEWS

Group Publisher LOUIS V. DeFRANCESCO JR.
Publishers DR. LOUIS V. DeFRANCESCO
YVONNE M. DeFRANCESCO
Associate Publisher GARY DOLZALL

Group Editor-in-Chief TOM ATWOOD
Executive Editor FRANK MASI
Senior Editor CHRIS CHIANELLI
Associate Editor GERRY YARRISH
Buyers' Guide Technical Editor FAYE STILLEY

Copy Director LYNNE SEWELL
Senior Copy Editor KATHERINE TOLLIVER
Copy Editor DEBRA D. SHARP
yers' Guide Coordinator LAURA K. GOLDBERG

Managing Art Director ALAN J. PALERMO
Associate Art Director BETTY K. NERO
Assistant Art Director STEPHANIE L. WARZECHA
Promotional Artist ROBIN DEMOUGEOT
Staff Photographer WALTER SIDAS
Image Technician LISA KNORRA

Systems Manager GORDON OPPENHEIMER

Director of Marketing GARY DOLZALL
Circulation Manager JEAN BINGHAM ABBOTT

Production Manager MARY REID McELWEE
Production Assistant ARLENE MELKO

Advertising Manager SHARON WARNER
Advertising Account Executives SHELLEY BYINGTON
JILL E. SHERTER
JILL ELLEN MOLINARO
JENNIFER IZZO
Advertising Traffic Coordinator ELISE SILKOWSKI

IBSCRIPTION PRICES: U.S. & Possessions (including APO & FPO): year (12 issues), $27.95; 2 years (24 issues), $49.95. Canada: 1 ar, $43.82; 2 years, $81.27 (Canadian prices include G.S.T.). ewhere: 1 year, $40.95; 2 years, $75.95. Payment must be in U.S. nds. Single-copy prices: $3.50 (USA); $4.50 (Canada). Canadian S.T. registration no. R130754872.

ODEL AIRPLANE NEWS (ISSN 0026-7295, USPS 533-470) is pub-hed monthly by Air Age, Inc., 251 Danbury Rd., Wilton, CT 06897. nnecticut. Editorial and Business Offices, 251 Danbury Rd., Wilton, 06897. Phone: 203-834-2900. FAX: 203-762-9803. Michael F. yle, Chief Executive Officer; Y.P. Johnson, President; G.E. Francesco, Vice President; L.V. DeFrancesco, Secretary; Yvonne M. Francesco, Treasurer. Second Class Postage Permit paid at Wilton, nnecticut, and additional Mailing Offices.

NTRIBUTIONS: To authors, photographers, and people featured in s magazine, all materials published in *Model Airplane News* become e exclusive property of Air Age, Inc., unless prior arrangement is ade in writing with the Publisher. The Publisher assumes no respon-ibility for unsolicited material. Only manuscripts and supporting mate-l accompanied by an SASE will be returned.

VERTISING: Advertising rates available on request. Please send vertising materials, insertion orders, etc., to *Model Airplane News*, vertising Dept., Air Age, Inc., 251 Danbury Rd., Wilton, CT 06897. one: (203) 834-2900. FAX: (203) 762-9803.

IANGE OF ADDRESS: To make sure you don't miss any issues, send ur new address to *Model Airplane News*, Subscription Dept., P.O. x 428, Mount Morris, IL 61054, six weeks before you move. Please clude the address label from a recent issue, or print the information actly as shown on the label. The Post Office will not forward copies less you provide extra postage. Duplicate issues cannot be sent.

ISTMASTER: Please send Form 3579 to *Model Airplane News*, P.O. x 428, Mount Morris, IL 61054

Member Audit Bureau of Circulations
PRINTED IN THE USA

IN MEMORIAM
RICHARD B. PURDY
September 21, 1922 - September 2, 1994

It is with a deep sense of loss that we report the passing of one of *Model Airplane News'* long-time contributors, Richard B. Purdy. More than just a writer and *Model Airplane News* plans consultant, Dick was a valued friend of Air Age Publishing.

A resident of Ridgefield, CT, he was a WW II veteran who served in the U.S. Naval Air Corps. As a Navy pilot, he carried out many assignments, including towing targets and transporting a variety of aircraft, ranging from fighters to the PBY Catalina. These experiences endowed him with a deep understanding of aviation and a passionate, lifelong interest in all types of aircraft.

He graduated from the University of Michigan with a degree in architectural engineering and worked as a corporate engineer at Ciba-Geigy in Ardsley, NY, before he joined Boehringer Ingelheim, where he retired at 62.

A talented modeler, Dick was a member of the Westchester Radio Aeromodelers (WRAMS), the Fairfield League of Yankee Radio Controllers (FLYRC) and other notable clubs. He built and reviewed many airplane kits for *Model Airplane News*. He worked closely with Air Age editors, and his workshop was always open to his flying buddies. His great modeling experience and knowledge, his weekly visits to the office and his uplifting sense of humor will be missed.

He is survived by Cynthia, his wife of 50 years; two daughters, Anne P. Fitzgerald and Martha Purdy; a brother, Douglas R. Purdy; and three grandchildren.

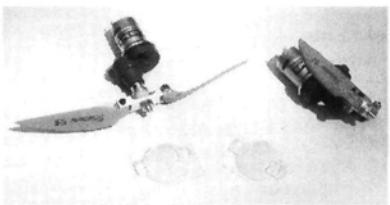
AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

ERRATA

The text set off by single quote marks below was inadvertently deleted from Elaine Jackson's article on the Bakersfield '94 Heli Fun Fly in our October issue.

"At the Miniature Aircraft booth, knowledgeable Wayne Mann was available to answer X-cell-related questions 'and display Miniature Aircraft's newest products. Miniature is constantly improving and updating their product line. Their new self-aligning dampened clutch (part no. 546) offers a CNC-machined unit that requires no time-consuming dial indicating. The dampened urethane isolators minimize noise and unwanted engine-pulse vibrations. Their new product line includes a CNC-machined aluminum fan (part no. 579-2), a dampened start shaft (part no. 573), a machined washout hub (part no. 571), a super Tri-axis gyro system (part no. 3819), adjustable roll bellcranks (part no. 536), an adjustable bell mixing kit (part no. 538) and a new FAI competition fuselage—the Windstar.'"



TWIN LIGHTNING POWER

In response to Gene Manno's letter in the May '94 "Airwaves," I'm enclosing this photo of my alternate P-38 electric powerplants. *[Editor's note: we reviewed the Kress Jets electric-powered P-38 in our November issue. Here, the manufacturer describes an alternative power system.]* Each unit uses a Graupner no. 1794 Speed 400 7.2V motor adapted to a Master Airscrew 2.5:1 gearbox that's mated to a Graupner 9x7 folding prop (a special adapter is provided). The gearbox comes assembled, and a gear is mounted on the motor's shaft. The props shown use a Kress Jets hub/spinner assembly. The weight of each prop is 0.9 ounce versus 2.1 ounces with the stock Graupner complete prop assembly. Total weight per unit is 131 grams or 4.6 ounces. Current draw is 7.6 amps. Motor rpm are 14,700 at max power, and rate of climb is 540 feet per minute for 5 minutes. At level-flight power settings, duration is 10.8 minutes using 1,100mAh cells.

These units can also be used in the Guillows P-38, but lighter batteries should be used because of the fragility of the model. Perhaps six or seven 700mAh cells would work because the Guillows P-38 is lighter. These units cost $54.20 each; they should be very useful for many multi-engine models.

ROBERT W. KRESS
Kress Jets Inc.
Saugerties, NY

Bob, thanks for the additional information. It seems that with a little mixing and matching, some really light, powerful drive systems can be built, and twin, electric-powered models are becoming more and more popular. The review of your electric-powered, belt-driven, twin-prop, single-motor P-38 in the November issue has sparked (pun intended) a lot of interest. With help like yours, the silent-power modelers of the world can look forward to higher, longer and faster flights. GY

STALKING A STAGGERWING

I read an article in the March '94 issue written by Dan Parsons entitled "Bomber Field Big Bird Fly-In." On page 29, there's a photo of a Beech Staggerwing. I'd like very much to build such an airplane, but I don't know of a source for plans or a kit. Can you help? Your assistance is greatly appreciated.

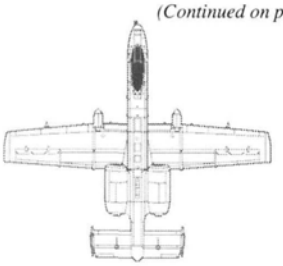
DALE PARRISH
Valdosta, GA

Dale, we have no further information on the photo of the Beech Staggerwing

taken by Dan Parsons, but a fiberglass and foam kit is available from Byron Originals. It's a great modeling project, and there are many colorful civilian models from which to choose. If you want a warbird, the Staggerwing Traveller was also used by the U.S. Army Air Corps, (designation UC-43) as well as by the U.S. Navy (designation GB-1 or GB-2). These Light Transport biplanes could carry a pilot and three passengers and 125 pounds of cargo. Byron's model has a 77-inch wingspan and is 65 inches long, and you'll need a 6-channel radio because the model is equipped with flaps and retracts. Suggested power for the model is listed as a Saito 270 4-stroke, a SuperTigre 3000 or a Quadra 42cc or 52cc gas engine. It costs $515 plus S&H; retracts are $278.15 plus S&H. For more info, contact Byron Originals Inc., P.O. Box 279, Ida Grove, IA 51445; (712) 364-3165. Incidentally, Dan Parsons recommends a Quadra 52 for best performance, and he invites interested readers to call him for comments on some of the success stories he has seen with this aircraft. You can reach Dan at (505) 296-2353.

Model Airplane News does have plans (no. GS00003) for a Beech Staggerwing G-17S in 1/4-scale. This 108-inch-span, 78-inch-long, all-wood (with foam-board ribs) biplane has exact-scale outlines. It's powered by a 3.7ci gas engine—perfect for a Zenoah G-62. The two very large sheets cost $31.50. You can order plans by calling our mail order department at (800) 243-6685. If any readers know of other sources for Staggerwing plans, please let us know so that we can pass along the information. GY

(Continued on page 155)



IN MEMORIAM

LOU PROCTOR

January 25, 1910 - July 16, 1994

The modeling world has lost another great pioneer. We regret to report that Lou Proctor has passed away at the age of 84. More than just a famous name in the world of scale modeling, Lou set a standard of excellence in kit manufacturing that few have ever matched. A lifelong modeler, Lou entered his first scale contest in 1929 and was presented with his second-place prize by none other than Charles A. Lindbergh. Later, and throughout WW II, Lou worked at the Boeing plant in Seattle, WA. In 1958, he moved to San Diego, where he was employed by Ryan Aeronautics, and he designed the prototype model of his famous Antic.

In 1965, Lou retired from Ryan, started Proctor Enterprises and produced kits of his Antic, which was soon joined by his Antic Bipe, Mini Antic and Antic Parasol. Throughout his modeling career, Lou never compromised the quality and craftsmanship of his products. His motto, "Pride of ownership comes with a Proctor kit," was reflected in every one of the kits. Many impressive, museum-quality kits were manufactured under his guidance. As a result of Lou's efforts, Proctor's broad line of vintage aircraft kits have become very popular.

Lou Proctor will be greatly missed. He is survived by Elsa, his wife of 39 years, two sisters and his nephew.

SIMPLE PROGRAMMING

DAVID C. BARON

OUR FIRST ANNUAL RADIO WISH LIST

WELCOME TO THE first annual *Model Airplane News* radio wish list. I want to thank you all for an overwhelming response to my request for ideas. I'm truly sorry if you don't see all your ideas here in print, but that may mean that I'm saving them for future articles! This wish list is divided into three categories:

- Hardware/mechanical changes to current radio designs. From entry-level to top-of-the-line models, these ideas should be considered for incorporation into current production radios.
- Programmable options that we don't have now, but we would like to see.
- Concepts that are worthy of starting with a fresh piece of paper.

My apologies in advance if we ask for something that is already available. (If it is, and we don't know about it, has it been advertised enough?) The following list includes the names of contributors and their comments. In some cases, I've added some thoughts (see italics).

HARDWARE WISH LIST

Tom Movaro, *Oxford, CT*

• **ON/OFF switch.** I would like a switch that can't be mistaken for a trim dial while you're flying. I think we've all either switched off our radios at an inopportune moment or come very close to doing so. There are plenty of "lockable" switches out there. The first that comes to mind is one that has a stem that must be pulled out to move the switch to the other position.

I'm sure that these switches cost considerably more than conventional ones, but many people wrote in specifically on this topic. DCB

Mark Bartley, *Dartsmouth, NS, Canada*

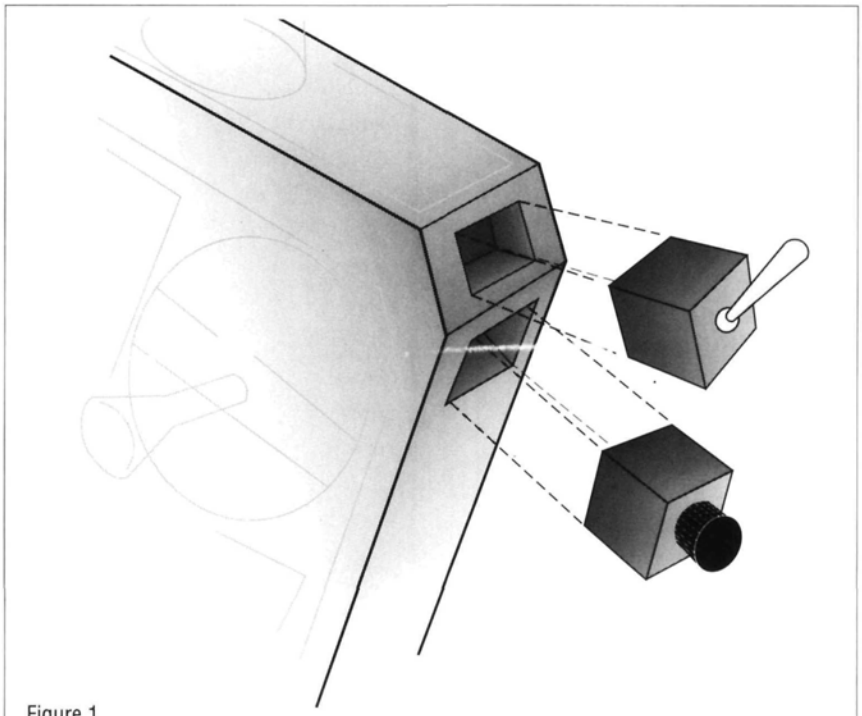


Figure 1
Plug-in/plug-out switches, knobs, levers and buttons.

• **Non-breakable antenna.** The rest of the world has high-tech and rugged antennas, why hasn't R/C kept up?

• **Replaceable/interchangeable switch blocks** (see Figure 1). You could remove (pull out) the student-trainer switch and plug in a slider pot to put flap activation where you want it. The radio's software would be told what function (channel) to assign the switch to and what direction activates the function. The blocks could be buttons, switches, sliders, knobs, etc.

I feel that there are too many switches on the tops of our radios that can wreck our planes, especially when they're not in use. I've already talked about switches with removable stems, but how about the ability to inhibit the trainer switch with another switch in the battery compartment? Or the trainer switch could be made inert until the trainer cord was plugged in. That type of a jack is certainly commonly used with headphones DCB

John Riggs, *Carmichael, CA*

• **Antenna with eyelet.** Transmitter antennas could have an eyelet at the end rather than the flat threaded disk that is so common. An eyelet would allow the simple attachment of frequency flags that would not inhibit the easy raising, lowering and stowing of the antenna.

Brian Park, *Brighton, MA:*

• **Metal transmitter cases for our better radios.** They are more rugged and can be anodized in any color.

PROGRAMMING WISH LIST

Mark Bartley, *Dartsmouth, NS, Canada*

• **Programmable logic.** An example

(Continued on page 12)

(Continued from page 10)

of current technology is mostly "IF" the ailerons go right, "THEN" the rudder goes right also to a specified amount. It would be nice to add "OR," "NOR," "NAND" and "AND" commands to our current logic system. For instance, the in-flight mixture adjustment for the engine could move a different servo (and a different needle), depending on whether the engine was at full throttle or low throttle.

• **Non-linear stick response.** Commonly on heli radios, this feature mixes 10 (or more) points of stick motion into non-linear servo motion. This is most often seen in collective-pitch setups and throttle curves. It would be a useful feature in aircraft that have flaps, spoilers and throttles.

• **Trim-mixing option.** This would allow the option of mixing in the trim when slaving channels. For example, if you slave a secondary channel to the throttle for a twin-engine aircraft, you don't want the throttle trim to control only one of the engines.

Some of the radio manufacturers have started to address this problem as JR has done with their 388's trim-on or trim-off ability *DCB*

• **Personal computer interface.** This user-friendly program would allow the transmitter to be easily interfaced with a PC and display the position or condition of all the programming options at a glance. Such a system would also be capable of storing model memories that are worth saving or subject to experimentation.

The Ace Micro Pro 8000 is already capable of this. It is certainly time, however, for other radio manufacturers to realize that almost all the customers who buy programmable radios also own PCs and would like to integrate them! *DCB*

Figure 3
The blending of a single-stick gimbal into a production radio. The new three-axis stick could "plug" into either gimbal for ambidextrous use.

• **Flaps tied to throttle settings.** Flaps could travel to different deflections, depending on throttle settings. When flaps were selected, full throttle would give you a partial flap value. Low throttle would give you full flap deflection for landing. A go-around would transfer from one flap setting to another at a controlled rate (adjustable).

• **A special throttle program for multi-engine models.** This would feature the activation of two separate trim levers (one for each engine). These trims would be independent of the normal trim, which would still be operational.

A second feature would link the rudder to the throttles. Any use of the rudder at less than one-quarter throttle would drive the two throttle servos in opposite directions. For example, right rudder would boost the left engine and retard the right. If you have ever taxied a large, multi-engine plane, this feature will make instant sense. Multi-engine aircraft tend to use a lot of runway when taxiing and turning. Possibly a secondary feature of such a mix would be a switch that allows rudder trim to affect the throttles (differential) at higher engine settings. This way, the plane could be perfectly trimmed out in yaw at higher engine settings.

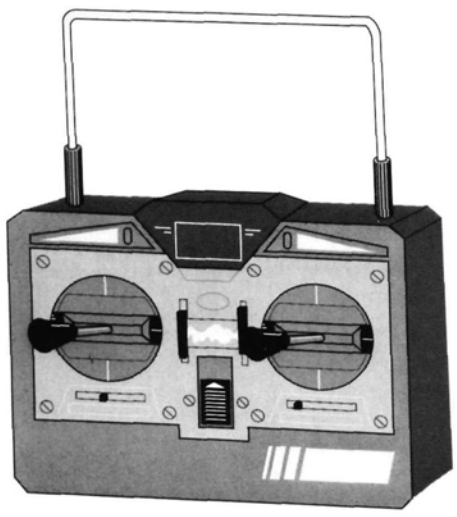


Figure 2
There used to be a manufacturer that had an oversized handle that doubled as its radio's antenna.

NEW CONCEPT WISH LIST

Jim Florio (kit manufacturer, competition flier and designer), *St. Marys, PA*

• **Transmitters custom-mixed at the factory.** You tell the manufacturer what channels you want mixed and how, and they incorporate this into a custom feature on your radio. This idea could be as wild as your imagination. In order to do this, the manufacturer would have to keep a certain amount of memory free, and customers would probably have certain guidelines that they would have to stay within, such as how many channels would interact in the mix and to what extent. Other options could be whether it would be possible to disable (inhibit) the mix.

Dave Platt, *Melbourne, FL* (famed scale modeler and kit maker):

• **Control sticks fitted with buttons or switches on the ends and/or on the stems.** This would enable the pilot to activate a variety of functions without taking his fingers off the control sticks. The military calls this "HOTAS" (hands on throttle and stick).

(Continued on page 127)

❖ The New Aristo-Valiant Tracker ❖

50 RF Channels Synthesized, Scanning + Full Computerization

POLK'S MODEL CRAFT HOBBIES INC., 346 BERGEN AVE. JERSEY CITY, NJ 07304
PHONE 201-332-8100 FAX 201-332-0521

s this the Ultimate Computerized Radio?

Aristо-Craft has been making radios since 1950, starting with sin- channel systems. This ne we challenged our engiers to come up with the rld's safest, bullet proof, ature filled, and user endly radio! They more an exceeded our specs for r dream radio!

isto-Craft learned how to ake a 50 channel synthe-ed radio and included anning with the Valiant 8, d have now enhanced the nctions to the ultimate ra- of the 1990's.

atures included are:

- **PPM or PCM selectable**
- **5 Model Memory**
- **Expotential**
- **Trim Memory & Rate**
- **Tx & Rx Bat. Check**
- **Aileron Differation**
- **Flaperons & Elevons**
- **V-Tail**
- **Countdown Timer**
- **End to End Point adj.**
- **Mode 1 or Mode 2**
- **Fast Servo Response**
- **50 RF Channel**
- **Scanning and R.S.S.I.**
- **2 Mixes - 3 Way**
- **Dual Rate Adjustable**
- **Bullet Proof Receiver**
- **Low battery warning**
- **Permanent Memory Settings w/Cmos chip**
- **Last Freq. Retention.**
- **Helicopter Compatible**
- **Cross trims**

The New Valiant Tracker is as Smart as it is Beautiful Fully computerized, programmable, scanning, and synthesized 50 channel selection without crystal change!

The Valiant uses state of the art Surface Mount Technology to insure perfect boards, and the boards are computer checked during production. Additionally, the Valiant Tracker has a self test every time the radio is turned on.

The connection between the transmitter and the receiver is accomplished through a communication cable to the mounted switch on the outside of your model. **All settings remain permanently in memory even if battery is removed.** Safety requires that scanning is required each time you change frequencies. All flag combinations are provided, so that full compliance with A.M.A. rules and compound etiquette can be maintained.

The Valiant Tracker is F.C.C. approved, and a ***patent is pending*** for the scanning and synthesizing of frequencies. **Please note that it is impossible to transmit on to a frequency in use** even in a field several miles away or on to a frequency with interference.

Therefore, it is impossible to shoot someone down by mistakenly turning on your radio while someone else is flying. We can't emphasize enough that ***this feature alone makes the Valiant the safest radio in Model Aviation History!*** **Available on 72 or 75 Mhz and Mode 1 or 2. Optional 6 additional on/off channels available w/decoder in separate case. All foreign frequencies will be available from agents. In Europe see Powermax.**

The Safest and Most Bullet Proof Radio!

POLK'S HOBBY has been in the hobby business since 1935, and their founders, Nat and Irwin Polk were founding members of the A.M.A. and are members of the Hall of Fame. This radio is not a fantasy from a new company, but the most serious project to bring deluxe capabilities to flyers at affordable pricing.

Our reputation of 60 years of supplying the hobbyist is on the line, and we want to make the Valiant everybody's basic radio of choice to do so we assembled an engineering team of experienced radio engineers to introduce ground-breaking technology to you.

Polk's will offer a **money back guarantee** to any member from each A.M.A. approved flying club for testing. Fly for 30 days without risk, and if you don't agree that the Valiant Tracker is the "Ultimate" radio than you can return the radio to us for a full refund. This offer is valid through 06-30-95

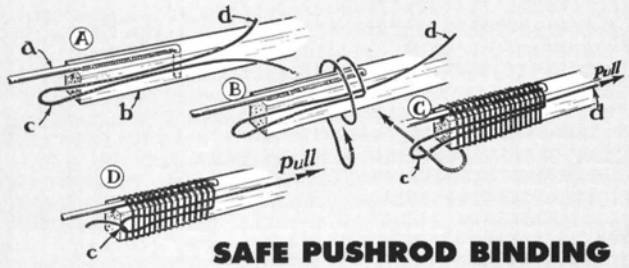
8 Ch Dlx. Sys. *$479.95
6 Ch Std. Sys.(1995)$379.95
Spare Receiver $149.95
Opt. 6 on/off $ 99.95

***SECOND RX DIRECT FROM ARISTO AT 1/2 PRICE WITH PROOF OF SALE! (INTRODUCTORY)**

HINTS & KINKS

JIM NEWMAN

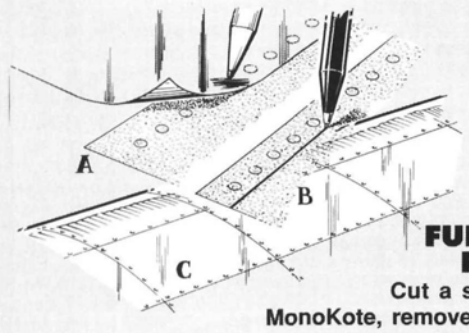
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive,we can't acknowledge each one, nor can we return unused material.



SAFE PUSHROD BINDING

A. Attach the wire pushrod (a) by piercing the balsa pushrod (b), then gluing the two as usual. Lay a loop of strong thread (c) alongside the balsa, leaving a long end (d). B. Take the thread over itself, then bind the two pushrods firmly together. C. Pass the end of the thread through the loop (c), then pull firmly on the end (d) until... D. The end of the thread and the loop are drawn completely behind the binding. Snip off the ends, then saturate the binding with glue.

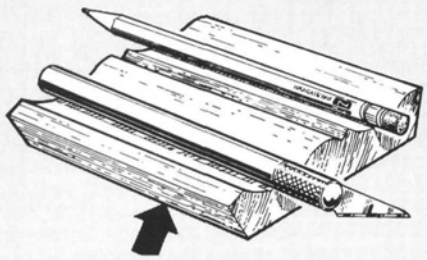
Harry Sutherland, Grand Junction, CO



FUELPROOF RIVETS

Cut a strip of clear MonoKote, remove the backing film, and then lay the strip on the bench, adhesive side up. Use a blunt, soft pencil to burnish on Chartpack RDC-1 rivets (A), then, with a fine, permanent-ink marking pen, draw lines alongside each row of rivets (B). Now flip the strip over so that it is adhesive side down, and iron it onto your model (C). The rivets and panel lines are totally fuelproof since they are now sealed under the MonoKote.

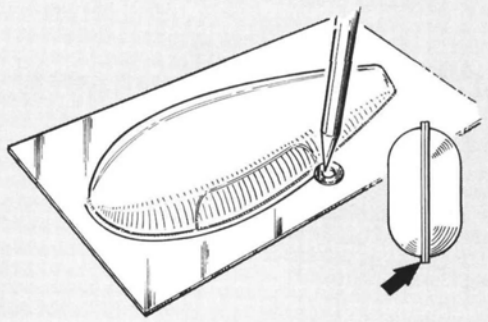
Charlie Seaman, Walton, NY



SIMPLE KNIFE HOLDER

A piece of crown molding from the lumber yard will nicely retain your knife and other small, round-handle tools and prevent them rolling off the bench and, perhaps, skewering your foot. Make it as long as you desire to hold all the tools normally used. A good safety hint.

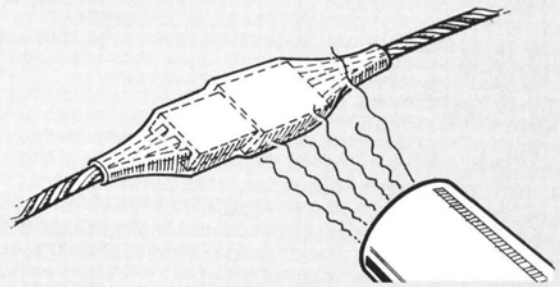
Tom Kirkpatrick, Louvier, CO



TRIM-LINE MARKING

Insert your pencil point into the hole of a washer, then place the washer against the part to be trimmed before running the pencil around its perimeter. The result will be a neat, evenly spaced trim line.

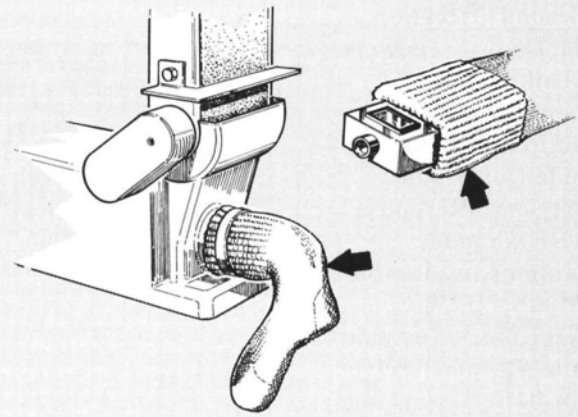
Keith Sparks, North Richland Hills, TX



SERVO CONNECTOR SECURITY

Slip a piece of heat-shrink sleeve over the connectors, then carefully heat the sleeve to shrink it, being very careful to not melt the servo wires. This sleeve will prevent the connectors from becoming unplugged.

Tariq Shah, Woodlands, TX



RECYCLED SOCKS

An old gym sock rubber-banded to the dust-collector nozzle of your sander will effectively trap sawdust, while another gym sock rolled double is a soft protective case for an electronic tachometer.

Larry Renger, Cerritos, CA

AIR SCOOP

CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

SILENT Air Show

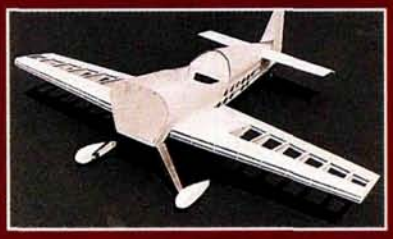
Designed by contest sailplane manufacturer Bob Sealy, the Brigadier is Hobby Lobby Intl.'s new hybrid, high-speed, electric sailplane. Its 64-inch, low-aspect-ratio, aerobatic wing has 660 square inches of area and a loading of only 21 ounces per square foot. Even with the low-priced Speed 700 electric motor, takeoffs are fast, and 6-minute aerobatic flights at high speeds with touch-and-go's are possible. Put a Mega or Ultra motor in its nose, and the Brigadier turns into a whistling missile that's capable of axial rolls, spins, snaps and giant loops. The fuselage is epoxy/glass, and the wing is balsa-sheeted foam-core. Hardware includes pushrods, steerable tail wheel, low-drag racing wheels (and there's much more). The instructions are written for those who have never finished a glass fuselage or sheeted foam wings.

• Contact Hobby Lobby Intl. Inc., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444.

FLASH! Just wait until you see Hobby Lobby's next catalogue. They're known for their unique products, but the new stuff in this one takes the cake!

Formula Fair

In a recent conversation, my long-time friend and modeling mentor Richard "The Lion Hearted" Uravitch related his excitement about a certain airplane he saw at Oshkosh this year—the new One Design. As Rich puts it, "The idea is simple: a single airplane design capable of being built at home, powered by a standard 180hp engine and flown in aerobatics competition against others exactly like it. Truly, a flying event where the pilot makes the difference." Rich was so taken by the airplane and the concept that he has drawn up a set of plans and built a ¼-scale (59-inch span) prototype (shown here). We plan to publish this version in the future. Rumor has it that Rich is already upsizing the model to ⅓ scale (80-inch span, IMAA-legal) for those of you who prefer something a bit bigger. Of course, he'll have canopies, cowls and wheel pants for both sizes. Drop me a line and let me know how you like it.



Sidewalk Air Wars

Based on the venerable F4U Corsair, Wings and Wheels brings us a kit of a pedal version for Junior. Not only will its folding wings, realistic instrument panel and steerable tail wheel make Jr. feel like a respected Marine pilot poised for battle, but it can also be used at your flying field to train those stubborn R/C pilots who can't seem to get the taxi pattern quite right. You know, the ones who take off from the pits cross field with no warning. A few hours of "driver's ed"—or should I say "taxi-etiquette"?—and they'll get the point. The metal-and-plastic kit includes such details as: oil-cooler intake, radial engine and housing, main landing-gear struts, tail wheel, tail cone, windscreen—and more.

• For more information and prices, contact Wings and Wheels, P.O. Box 1510 MMT, Jacksonville, OR. 97530; (503) 878-1473; fax (503) 878-1461.

I understand Frankie Tiano has sold his golf cart and ordered one so he can patrol the Palm Beach Polo Grounds as Pappy Boyington during this coming '95 Top Gun.

The giant-scale sport plane has certainly been greeted with open arms by the modeling public; witness the success of Lanier's big Stinger. Thanks to Stream Inc., we now have the sleek Akro Pro 180 to join the ranks of IMAA-legal sport designs. The kit includes all wooden parts, canopy, ABS cowl, landing gear and wheel pants (no hardware). Specs: wingspan—82 inches (two-piece); wing area—1,300 square inches; weight—15 pounds. Suitable engines include the Moki 1.80, the O.S. 300 twin and Saito 270 and 300 twins. The Akro Pro's structure will handle ignition engines up to a G62.

• Contact Stream Inc., P.O. Box 1113, Newport News, VA 23601; (804) 591-0720

AKRO 180 PRO

Stall-Warning Alarm

Hobbytech Inc., of Elgin, IL, has developed a stall-warning alarm for R/C modelers. I know what you're saying at this point: "How are you supposed to hear a warning buzzer during a busy day at the flying field?" I asked the same question. Well, Hobbytech thought of that, too: the unit comes with a *very loud* alarm. The easy-to-install/remove box measures 2.27 x 2.40 x 1 inches and weighs less than 4 ounces. For advance warning that a stall is about to occur, the unit's sensor monitors the physical dynamics of the airflow over the airfoil. Its sensitivity is adjustable.

• Contact: Hobbytech Inc., 34 Joslyn Dr., Elgin, IL 60120; (708) 695-5903; fax (708) 837-6235.

Self-Portrait

Vic Obsatz provided us with this photo of a miniature bust in his likeness, and we can confirm that it very closely resembles him. How does he do it? Are his techniques readily adaptable so that the rest of us can fly miniatures of ourselves in our own models? The answers are coming in a future issue....

Much-Needed Mufflers

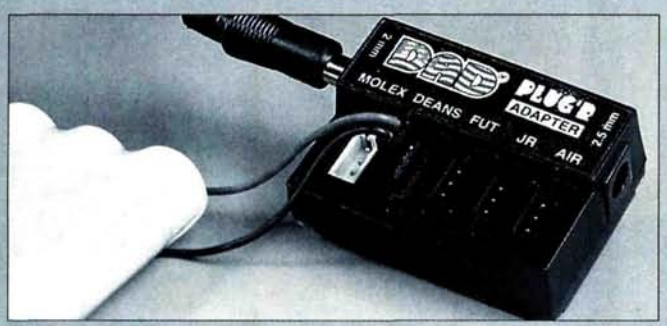
There's a new line of mufflers that everyone should be aware of. Called "Bisson," they're made in Canada and distributed exclusively in North America by Gerard Enterprises Inc. The line appears to be very well-made and very extensive. Not only are there mufflers for upright, inverted, side- and inside-out-mounted engines, but they're also available for a variety of engine types, including the increasingly popular larger sizes. They're ready for immediate shipment.

• Contact Gerard Enterprises Inc., W. 226 N825 Eastmound Dr., Waukesha, WI 53186; (414) 521-0547; fax (414) 521-0551.

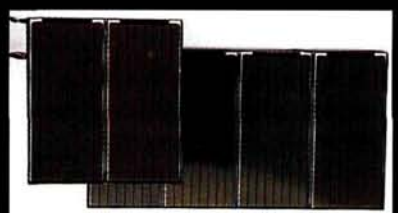
Connection Confusion?

End the dreaded workbench bird's nest of wires! DAD Inc. introduces the "Plug'r"—the economical solution to every R/Cer's need to connect incompatible plugs on the many servos, batteries, testers, timers, charger, cyclers—you name it—we use. The American-made DAD Plug'r helps us to fit these devices together, regardless of plug incompatibility. Simplify connections between: Ace-Deans, Airtronics, Futaba, FM, Hitec-World-Molex, Hitec-World-Aristocraft "S" and JR.

• Contact DAD Co. Inc., 168 Main St., Chadron, NE 69337; 1-800-669-4548.



The Free Loader



Put the high-output solar cells of Hobby-Tec's new Free Loader into the direct rays of the sun, and top off your receiver and transmitter Ni-Cd batteries all day long—safely and reliably, according to the manufacturer. The 3x3-inch RX (for four cells) and 3x6-inch Pro (for four, five, six and eight cells) can stand alone or be mounted on your model or toolbox. No heavy 12V batteries to carry; no timers; no over-charging damage; and nothing to wear out! Prices: RX—$19.95, Pro—$29.95.

• Contact Hobby-Tec, P.O. Box 220762, Santa Clarita, CA 91322; (805) 254-4242.

SU-do-KHOI

We brought you the *Profile Hots*. Now we bring you the ***SU-do-KHOI***, a more advanced member of the Profile series. It does tumbling maneuvers. How about a double lomcevak? The ***SU-do-KHOI*** does it. The ***SU-do-KHOI*** does wing tip spins, both inverted and regular flat spins, and crazy spins that are indescribable. The ***SU-do-KHOI*** is a great snapper. When mated with the MVVS 40, it does all the maneuvers that the *Profile Hots* does. Hold it in you hand and release it for an up and out of sight. Take it off in three feet, turn it straight up, stop at ten feet, hang as long as you like then do a tail slide. When the tail touches, back up to ten feet, then do another tail slide but this time after the tail touch it drops forward for landing on the wheels. Feel daring? Come out of a flat spin at three feet and land at you feet. Want a challenge? How about a horizontal figure in the hover attitude? That maneuver is tougher than it sounds. Master it and you are among the best.

These planes were designed for use with th MVVS 40, the most responsive 40 I have ever seen. Thi responsiveness is very helpful in the hovering maneuver It is very powerful - pulling a 10 x 5 APC pro 15,800 RPM's. It's all on tape!

Either tape is $10.00 or both for $17.50. Make a cop and return the tape for credit on your next order. Th *Profile Hots* kit is $64.95 and the ***SU-do-KHOI*** is $79.9 The Combo includes the engine and tuned silence $194.95 for the *Profile Hots* and $209.95 for th ***SU-do-KHOI***. Shipping and handling add $5.4 VISA and MasterCard accepted; Air International orders extra. Call Morris Hobbie today at 1-800-826-6054 or (502) 451-090 Can't get through? Call 1-800-468-3867 Hom Access #423 (evenings and weekends).

Ask about our volume discount!

MORRIS HOBBIES

1169 Eastern Parkway • Louisville, KY 40217 • 1-800-826-6054

▶ ***AIRTRONICS-RADIOS***		
VG4R 4 channel FM		129.45
VG4R 4 channel FM 2 - mini servos		175.45
VG6DR 6 channel FM 4 - 102 servos		169.95
VG6H 6 channel H 4 - 102 servos		244.45
VG7P 7 channel FM 4-102 servos		244.45
CLP3/143 ch. computer 75mh		279.95
Quasar helicopter radio		279.95
Mini BB servo		26.95
IN600A 6 channel FM 4 servos		329.99
IN600A 6 channel PCM 4 servos		369.45
IN660 6 ch. computer 4 servos FM		359.96
IN660 6 ch. computer PCM 4 servos		378.96
Quasar computer radio		269.95
102 std. servo		13.75
94322 Heavy Duty B.B. servo		22.97
▶ ***A-JUSTO-JIG***		$69.99
▶ ***HITEC RADIOS***		
Prism 7 FM computer		239.95
HS300 servo - J, Airtronics,JR endings 4/		42.85
Focus 4 channel FM		122.99
Focus 6ch FM		154.99
Micro 535 4ch FM Receiver		64.95
Supreme 8 channel FM receiver		62.35
▶ ***FOX ENGINES***	w/o muffler	w/muffler
FOX 15 BB	52.95	56.95
FOX 25 RCBB	64.45	68.45
FOX-25RC	54.95	58.95
FOX-40 Economy	53.75	57.75
FOX 40 Standard	62.95	66.95
FOX 40 Delux	75.95	79.95
FOX 45 BB New Price!	81.95	88.95
FOX 46	85.95	92.95
FOX 50 BB RING	89.95	96.95
FOX QUICKEE 500	-	135.95
FOX 60 RING	104.50	111.50
FOX-60 ABC	119.45	126.45
FOX 74 EAGLE RING	115.45	122.45
FOX 74 ABC	125.95	132.95
NEW-FOX-SUPER-QUIET-MUFFLER		28.95
FOX-RC-LONG-PLUGS		
(card of 12) per plug		1.45
FOX-FUEL price per 4 gal case-	10%	55.00
	5%	48.00
BYRON FUELS	same price	
OTHER-FOX-ITEMS		call
▶ ***MVVS (CZECH) ENGINES***		
.09 DIESEL		49.99
.12 DIESEL		50.53
.12 GLOW-ABC		50.53
.15 DIESEL DBBRC		69.99
.15 ABC RC DBB		72.99
.15 GLOW ABC DBB w/VENTURI		57.89
.15 DIESEL w/VENTURI		57.96
.21 ABC RC DBB		82.99
.21 CAR-ENGINE DBB		112.99
.40 PYLON DBB		130.99
.40 ABC RC DBB		103.75
.40 Q500 SIDE-EXHAUST w/muffler		199.95
.52 U CONTROL DBB		149.99
.61 ABC RC DBB		159.99
.61 DIESEL DBB w/glow head		199.99
▶ ***ACE***		
Ace power handle		24.9
Ace christy mixer		39.9
Ace christy mixer w/ends		56.9
Ace flight pack mini ESV		14.9
▶ ***VA (RUSSIAN) ENGINES***		
.049 Racing Engine		49.9
same with muffler		59.9
▶ ***ROYAL-ENGINES***		
.40 RC BB SCHNUERLE with Muffler		66.9
.25 RC BB SCHNUERLE with Muffler		58.(
▶ ***MOKI ENGINES***		
.15 ABC Racing Model		102.9
.15 Sport Model		54.(
.15 Sport RC BB		78.(
.61 LS ABC-Ring		163.9
.61 LS ABC		163.9
.61 Rear Exhaust		154.9
.61 Glow with Diesel Head		199.(
1.80 Ring		249.9
.51 RC Front Rotor Ring		151.9
3.6 Inline Twin		550.9
Moki Marine .40		185.9
Moki Marine .90 ABC		293.9
▶ ***K & B ENGINES***		
20 RC Sportster		47.9
40 RC		66.7
45 RC (FAN)		139.4
61 RC		78.9

Ted Russell's r
cent, 120-inch
Flying Boat on
from a lake in
Columbia. Des
built and flown
Ted, it uses En
4-strokers—be
music. Ted's s
also includes a
inch twin Otter
floats, 96-inch
120-inch CL21
bombers and a
inch Beaver on
They're all fine
in Ted's capabl
hands. He is ar
the top designe
builder and flie
waterborne pla
the North Amer
continent.

Multi-Engine Techniques

Story and photos by DAN PARSONS

Simple solutions for flying with two or more powerplants

This is another rare model from British Columbia—a 114
twin Seabee scratch-designed, built and flown by Marc W
This beauty is powered by 120 4-strokers. Twelve full-sca
Seabees have been modified as twins. It greatly
enhances their performance.

A deHavilland Rapide scratch-built by Curly Rucker (piloted by Tom Blakeney).

THOUGH MULTI-ENGINE R/C models have been around for many years (I flew my first twin, an ME 210, in 1960) few mu are seen at even the largest meets. In fact, there appears to be even less now than there were a few years ago. I recently returned fro the big fly-in at Greenville, SC, where 267 pilots brought over 400 planes but only four multis. Why is this? Two main reasons: one, few kits or even plans are available, and two, the well-founded reputation of multi-engine models for their short lives, especially scale. I believe many modelers are interested in multi-engine planes, particularly twins, but all too often they have seen twins have engine problems with disastrous results. They then conclude, "That's not for me."

Ted Russell's Empire flying boat approaches liftoff.

This article will discuss the differences etween and the problems of multi-engine /C models and the solutions to those prob-ms. I hope the result will encourage more odelers to take on the always challenging d interesting project of building and fly-g a multi-engine model. I'll be talking out twin-engine models, but the same rinciples apply to models with more than vo engines.

I want to stress that there are a few big ifferences between building and flying a ngle-engine model and a twin-engine odel. It's extremely important—and I n't over-stress this point—that any mod-er planning to build and fly a twin should ow and understand these differences.

Now, a quick run-through on design and onstruction basics.

rare Fokker F-27, scratch-designed and flown Art Schneider in a spectacular manner. Fox is with tuned pipes really haul this 108-inch ier.

DESIGN BASICS

ince the engines are in the wings, the fuse-ge can be kept light because structurally, 's only attaching the tail feathers to the ing. And speaking of weight, it's impera-ve to keep the tail feathers light, because any twins have short nose arms and long il arms, so they tend to become tail heavy. on't let the two engines sticking out from e wing fool you into thinking you've got lenty of weight forward and therefore don't ave to worry about becoming tail heavy.

The engines should be set straight ahead o right or left thrust) with 1 to 2 degrees of ownthrust. For most twins, I feel it's best to perate the throttles with one servo and to ave a separate tank for each engine, with ch tank set up just as it would be in a sin-le-engine plane. Also, if at all possible, have hatch so each tank is easily accessible. ngine reliability is an absolute must in vins, so the engine and fuel system must be sy to get at if there is a problem or during utine maintenance.

With many twins, it's possible to simplify e construction by building the engine acelles as separate units—just like a fuse-lage—and then gluing them onto the completed and covered wing. I've done this with all my twins, and it works very well.

The author with his deHavilland Hornet at a 1989 Houston fly-in.

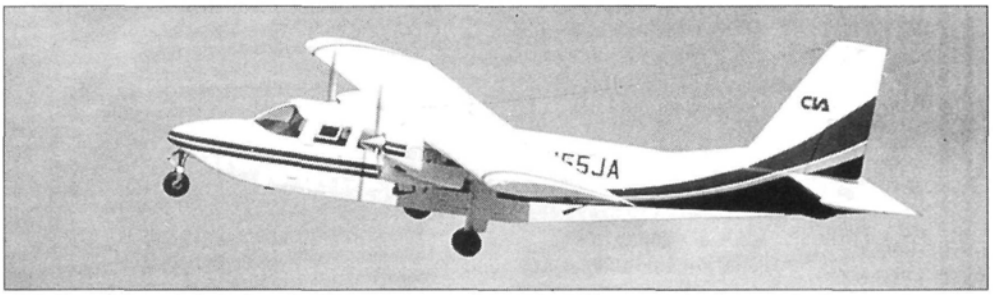
Most twins are fast, so to help prevent flutter, it's imperative to keep the control surfaces light and the linkages tight and stiff. If in doubt, statically balance the control surfaces.

With the rather simple construction differences out of the way, let's get on to the preparations for flying.

By far the most important factor in flying twin-engine models is to keep both engines running properly, especially at the full-power setting. Sounds plausible, doesn't it? But it has been my observation that, in actual practice, most new twin fliers concern themselves much more with engine synchronization than with having each engine set for proper running. Wrong! Wrong! Wrong! Engine synchronization isn't really a problem, whereas setting each engine properly is critical and must be the primary concern.

Fortunately, setting the engines properly is simple. The simple and obvious, however, is often overlooked as we concentrate on another "problem," i.e., synchronization, which really isn't a problem at all. Sadly, the lifespan of a high percentage of scale twins is very short, and the primary reason for their loss is the unexpected loss of one engine.

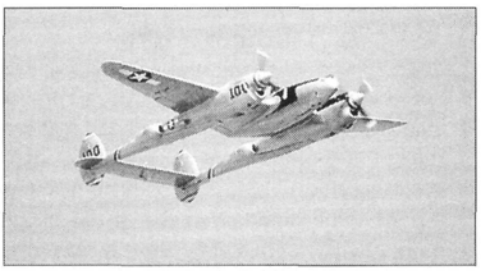
So here's the "secret" to setting the engines so that they run reliably flight after flight. Treat and set each engine just as if it were on a single-engine model. Simple? You bet. With the plane horizontal and the throttle wide open, have the engine running rich so that it's four-cycling, then lean until a solid two-cycle is achieved. Then hold the model vertical for at least 10 seconds to make sure the engine is not too lean. Ideally, when the model goes to the vertical, the engine should slightly increase in rpm. If the engine sags at all, it's too lean.



Bob Francis' scratch-designed, 120 F.S.-powered, 114-inch Norman Islander weighs 30 pounds. It has excellent design features for an easy-handling twin: shoulder wing, low dihedral and trike gear.

When you're satisfied that the first engine is set correctly, shut it down, start the other one and go through the same procedure. It's a good idea to "richen" each engine very slightly from these settings, just to be on the super-safe side. Check the idle setting of each engine and adjust it for a reliable idle. However, give priority to absolutely reliable running at the full-power setting.

Now here's the crucial part of this whole engine-setting procedure. When you fire up both engines to fly and do your full-power check with the plane held both horizontally and vertically, do not—I repeat, do not—touch the needle valve of either engine. Most



Kerry Hurt's 100-inch P-38 from the Baker kit keeps flying (ST 3000s). Kerry has been flying it for two years and puts on a good show.

COUPLING OF ENGINES AND RUDDERS

Another even rarer model, also in British Columbia, is Walt Moller's 114-inch DO 217 that he scratch-designed and built. ST 2500s provide plenty of power for this highly detailed beauty.

One area where multi-engine models have a distinct advantage is taxiing on water. A few years ago, I watched several large flying boats being taxied with ease in windy conditions during a water fly-in on a beautiful lake in British Columbia. The fliers accomplished this by having a switching system that tied the engine/engines on each side of the wing into the rudder action. If the pilot wanted to turn right, he'd give right rudder and the left engine/engines, on advancing the throttle, would come up on power while the right engine/engines remained at idle. The result was an immediate right turn, regardless of the wind.

Once in takeoff position and headed into the wind, this coupling of the engines and rudder is disengaged, and a normal takeoff is made. Come to think of it, this would work fine on land multi-engine models also, though I've never seen it.

I'd like to say a few words about the water fliers of British Columbia. First, there are many of these modelers (lakes everywhere and not much flat land), and they're absolutely the best I have seen anywhere. You couldn't find a friendlier bunch of R/Cers.

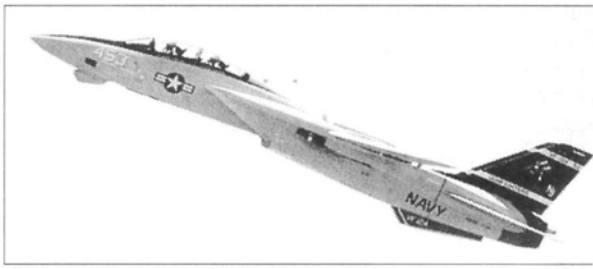
of the time, (and this still surprises me), the engines will pull closely into sync, especially when the model is held vertically. If they're a bit out of sync, don't worry about it! Go fly! If they're way out of sync, shut both engines down and go through the previous engine-setting procedures, one engine at a time. You'll probably get it right the second time around.

I can't overemphasize the importance of not tweaking one or both needle valves while both engines are running. If you do, you run the real risk of getting at least one engine too lean and losing it shortly after takeoff (worst case) or on the climb-out.

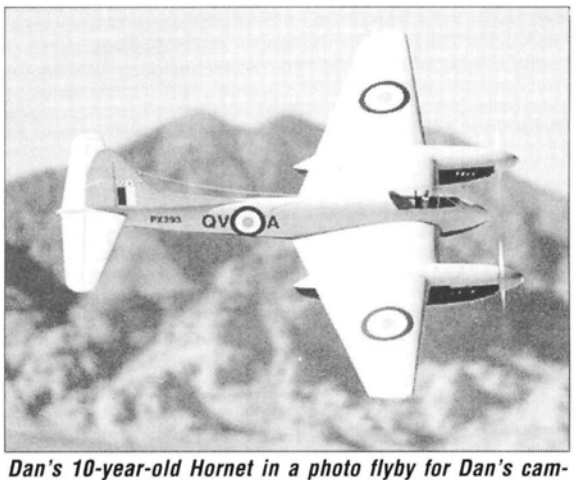
Once the engines have been set properly and operate properly in the air, they usually will remain so for all day or even a weekend of flying, unless there's a drastic change in the temperature or humidity. However, to be on the super-safe side, I always check for proper engine running before each flight by holding the plane vertical for approximately 10 seconds with the engines at full power.

Using these engine-setting procedures on more than 300 flights on my deHavilland Hornet over a period of 10 years, I've had near-perfect engine sync on an estimated 85 percent of my flights and have had only two engine failures because one was set too lean.

In both cases, I was flying with several other planes and couldn't hear my engines most of the time. Thus, when one went lean, I couldn't hear it and kept flying until it overheated and quit. This is one of the best reasons to set your engines properly and then just a bit richer than if you were flying a single-engine plane (not too rich, mind you, or you'll lose significant power and waste fuel). Ah, the challenges of twin-engine flying.



Full scale or model? Dennis Crooks' F-14 from the Yellow "swings wing" during a performance at Miramar N.A.S.— hom the full-scale Top Gun.



Dan's 10-year-old Hornet in a photo flyby for Dan's camera—Frank Noll piloting. It was shot in 1991 at a dry lake near Las Vegas, NV.

TAKEOFF TIPS

Now, on to the flying, but first, an important word on takeoff procedures. Any twin, especially a tail-dragger, has the occasional problem of swinging out of control at the start of the takeoff roll because of one engine coming up ahead of the other engine. If this happens (and it will), immediately abort the takeoff by chopping the power. By the way, proper abortive action requires that you think about it just before advancing the throttle; chances are, you'll get lots of practice with your twin.

Generally speaking, I've found it help come up on the power slowly while hol full up-elevator to keep the tail wheel or ground to provide steering during the part of the takeoff roll. Remember, a r has very little prop blast over the rudder the air speed increases, the rudder begi bite the air, and I can ease off the elevato the while smoothly advancing the thro It's a closely coordinated action and w beautifully when done correctly. It t practice and concentration. But that's pa the constant challenge of twin flying keeps it so interesting.

WHEN AN ENGINE QUITS

Even though you always set engines on your twin properly, in a great while, you're going to an engine owing to plug failu something as inexcusable as fo ting to refill one tank (I've that). So, what's the best proce to follow when you lose engine?—depends on your s and the power setting.

First, if you're flying fast at power—straight and level—and an engine, you probably won't know it for a bit, especially if planes are flying and you can't your engines well. Your plane gradually slow down and per assume a slight yawing attitude the dead engine. You'll think somebody may tell you), "I be I've (you've) lost an engine." Once you suspect this, prepare to land ASAP.

If you have plenty of altitude, no prob just throttle back to a couple of clicks a idle and come on in and land. Keep the down slightly to keep your speed up make gentle, rudder-coordinated turns. a fairly high approach, and ease in any p on the good engine if you need to lengthe glide. A small amount of power on that engine helps you lengthen the glide a bu

215 water bomber scratch-designed to exact scale by nadian Don Hatch (Wankel power).

> "If you lose an engine while climbing out or doing some maneuver at slow speed and full power, the plane will very likely flip up and over in a snap-like action"

n't use any more power then you have to, ı't get low on the approach, and don't get w!

If you lose an engine while climbing out or ng some maneuver at slow speed and full wer, the plane will probably flip up and ɛr in a snap-like action. When you see this, nediately throttle back to idle and concen- e on getting the plane stabilized by keeping nose down to pick up safe flying speed. ɛn gently level off. If you still have plenty altitude at this point, follow the procedures viously discussed.

In the case of losing an engine while flying ' at high speed, you'll have to keep full- or ır-full power on the good engine to keep up ır speed and maintain what precious alti- le you have. Don't let your plane's nose ne up and, thus, bleed off speed; make ɔrdinated, gentle turns, and you'll have an ɛellent chance to make it back to the field.

If you have the misfortune to lose an engine ile low and slow at full power, the plane l probably do a "whoop-dee-do," and you'll ɔbably have bought the farm.

DON'T KICK IN RUDDER

ıen you lose an engine, don't worry which ɡine quit. Believe me, you probably won't ɔw which engine you've lost for quite a ile, so don't even think about kicking in ɔosite rudder or rudder trim.

In the surprise, excitement, fear and tension lowing the loss of an engine, especially if plane does an immediate "whoop-dee-do," ın guarantee you won't know which engine went out, much less which rudder and/or rudder trim you think you ought to put in. And if you kicked in the wrong rudder, you may well do your plane in right then and there. (Pilots of full-scale craft have shut down and feathered the good engine, and they're sitting in the plane!)

In other words, just continue to control your plane with the sticks so it's flying properly. This is much easier said than done, but it's exactly what your top fliers such as Ted White, Frank Noll, Stinger Wallace, Al Casey, Bob Frey and Tom Street do when confronted with the engine-out situation. They automatically move the sticks to maintain the proper attitude and speed of the plane. It's not automatic for me, and I may not perform properly. But at least I know what should be done because I've seen them do it, more than once, and it always works.

Speaking of turns with one engine, I'm sure you've heard the old saying, "Never turn into the dead engine." There's nothing wrong with turning into the dead engine, as long as you keep the turn gentle. In fact, turning into the dead engine is the natural inclination for your twin. It may well be easier than turning into the running engine, which will probably require forceful use of the rudder, which will create more drag and slow you down. To recap, turning into the dead engine is OK; just keep the control actions gentle.

LAND AT ONCE

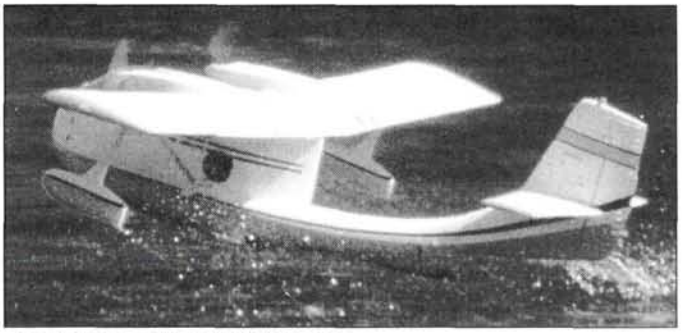
Never, ever, make a go-around on one engine because of a too-high approach unless you are an exceptional pilot, which also says that you're especially good on the rudder. Go straight ahead no matter what—better that than a sure up-and-over snap into the ground and total destruction.

Ninety-nine percent of your twin-engine flying can be completely free of all the foregoing if you just set the engines properly, thus not losing one. This is the reason why I stress knowing how to set the engines and religiously sticking to this procedure.

ENGINE SIZE

The subject of engine size is very important. The size is determined by one engine being powerful enough to maintain the plane's altitude and sufficient speed to provide good controllability. Err on the side of engines too large—you can always throttle back.

So there you have it—easy and fun twin flying is simply a matter of reliable engines running just as they always do on your old, trusty, single-engine, weekend sport flier. Just think of those engines on your twin as two singles that just happen to be joined by a wing, and set them accordingly. Do this and I guarantee you'll have invigorating, wonderful and always challenging times with your twin. Besides, where else can you get that magical sound? ■



Another view of Marc Wold's Seabee.

'Y Catalina in a graceful flyby with Harry ɔods at the controls. He usually flies ducted ıs.

About the Author

Dan Parsons has been involved in R/C since 1952. His primary interest is designing, building and flying "different" WW II fighter-type scale models.

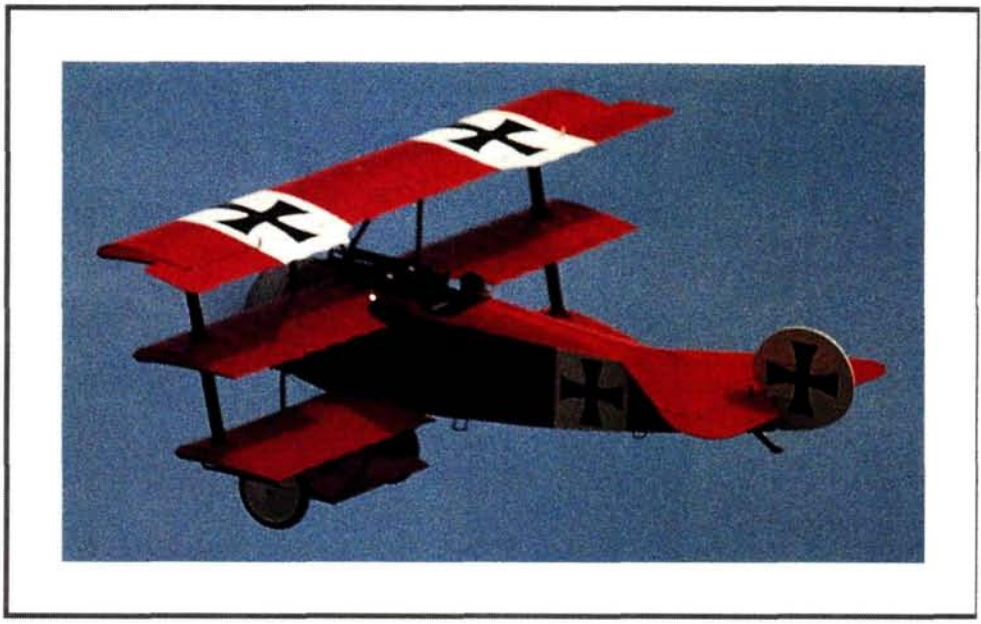
His first twin was an 84-inch-span ME 210 fighter/bomber. He started flying it in 1961 and flew it for three years on reeds. His latest is an 80-inch deHavilland Hornet fighter that he has been flying for 10 years.

Dan has been living in Albuquerque, NM, since 1951. He retired from Sandia National Labs in 1977 where he worked for 25 years as a mechanical engineer.

When he isn't going to meets all over the country, he's writing articles on R/C, consulting on mini-RPV's and running Dan Parsons Products.

FIELD & BENCH REVIEW

by SAL IASILLI



The Red Baron's ride—in a museum-quality kit

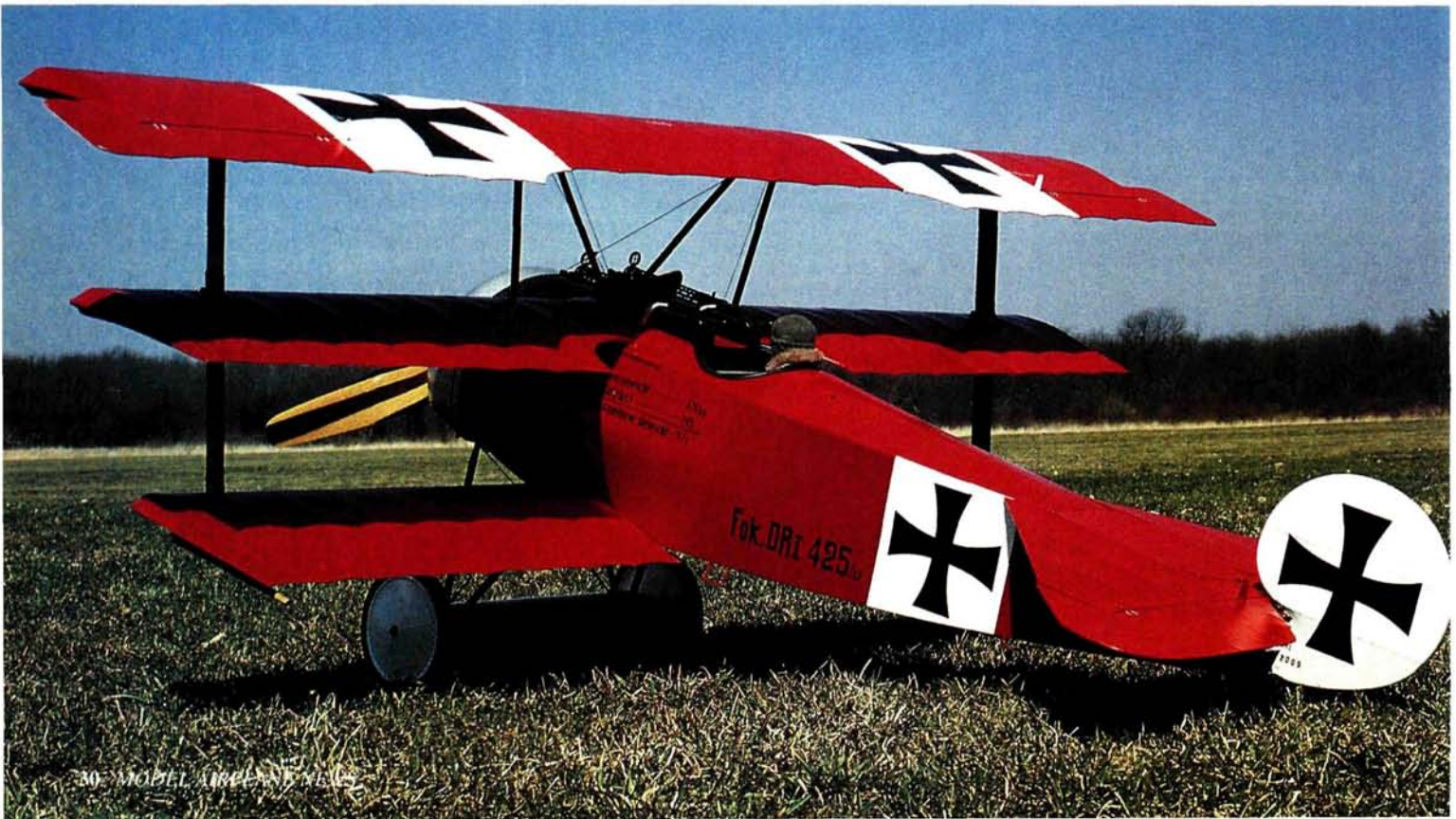
IT HAS BEEN NEARLY 77 years since the development of Anthony Fokker's legendary Dr.I triplane, but its appeal has not faded. The Dr.I is considered the most famous and well-remembered plane of World War I—largely because of the ace pilots who flew it. What makes this so extraordinary is that only 320 were ever built, and its actual operational life was only six months of combat duty.

Many of the earlier triplanes suffered from structural failures that almost brought about the demise of the design. Building materials were in short supply, and delivery demands, which were almost impossible to meet, caused shabby workmanship and corner cutting. This resulted in an investigation that ultimately grounded the triplane until the problems had been alleviated.

Although the triplane was considerably slower than the planes of its day, whatever it lacked in speed it more than made up for in its extraordinary rate of climb and superior

GLENN TORRANCE MODELS

Fokker Dr.I Triplane



SPECIFICATIONS

Model name: Fokker Dr.I triplane
Type: WW I scale
Manufacturer: Glenn Torrance Models
List price: $438 (plus S&H)
Weight: 15 lb.
Length: 56.79 in.
Wingspan: 70.86 in.
Wing construction: built-up
Wing area: 1737.5 sq. in.
Wing loading: 19.89 oz. per sq. ft.
Airfoil type: under-cambered
Washout built into wing?: no
No. of channels req'd: 4
Radio used: Futaba
Kit construction: fiberglass cowl, built-up components
Engine recommended: O.S. 1.60 Twin
Engine used: O.S. 1.20 Surpass II
Prop used: Master Airscrew Classic 18x6

The completed airframe showing its scale structure.

Comments: a truly scale WW I fighter, Glenn Torrance's Dr.I can be built in as little as four months by anyone who has moderate experience. The precisely cut parts for the built-up wings and fuselage go together nicely, and the included hardware is of high quality and adds to the kit's scale appearance.

Hits • The workmanship is of exceptional quality, as are the large four-sheet, multicolored, computer-drawn plans and the smaller reference plans.

• The 70-page construction manual is well-written and easy to understand.
• The triplane's flying characteristics are convincingly realistic, making it a very competitive aircraft for serious competition.

Misses • The rear undercarriage struts had to be slightly modified inward to permit the fitting of the lower wing to the fuselage. (Future kits will be redesigned to alleviate this problem.)

maneuverability. A quote from Germany's most famous ace pilot, Manfred von Richthofen states, the triplane "...climbs like a monkey and maneuvers like the devil."

Unfortunately, the ravages of both World Wars destroyed the last remaining original Fokker triplanes, which had been used for exhibitions and museum displays in Germany. All that remains today of von Richthofen's triplane is the Oberursel, 9-cylinder rotary engine, which was restored in 1989 by the Imperial War Museum in London, where it is now on permanent display.

THE MODEL

Glenn Torrance Models'* ¼-scale Fokker triplane kit is a testimonial to Glenn Torrance's passion for perfection. Before the prototype was built, over a two-year period, he corresponded with aviation historians throughout the world, gathering as much information about the triplane as possible and storing it in his computer data bank. His goal was to have the most accurate model triplane possible.

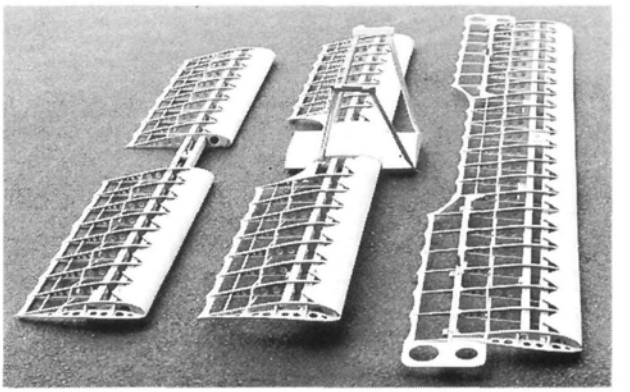
The prototype was built and flown by Bob Hanft. It successfully competed in Top Gun '91 and the 1991 USA Scale Team tryouts. With the Fokker triplane, Bob also placed seventh out of 60 contestants at the 1992 World Scale Competition.

The kit can be built for serious competition or for fun flying.

KIT CONTENTS

• Four pages of full-size, multicolored, first-generation CAD-drawn plans; a smaller set of identical plans for reference; five-view drawings; and step-by-step instructions with a complete bill of materials.
• Fiberglass cowl with cable groove.
• Brass fittings, hinges and control horns; aluminum tubes and struts.
• 1/32-inch-thick, machine-cut, balsa and hardwood parts; die-cut, plywood wing ribs.
• All related hardware: screws, nuts/bolts, rivets, cables, eyebolts, turnbuckles, etc.

The contents of the kit on opening the box.

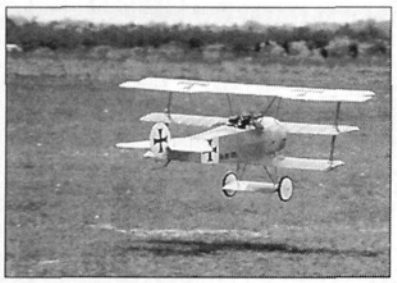


The completed three-wing assembly showing scale construction.

FLIGHT PERFORMANCE

• Takeoff and landing

Takeoffs are surprisingly easy, as long as the throttle is advanced gradually and a bit of right rudder is applied with a touch of up-elevator. Before you know it, the tail rises, and the triplane is airborne in less than 100 feet. The full-scale triplane and the model have earned a reputation for their less-than-favorable landing habits—namely, always wanting their nose to kiss the ground on landing. But landings don't have to be difficult as long as several things are kept in mind. Avoid landing in a crosswind; maintain a steady, moderate speed until touchdown; and stay on the controls until the model comes to a complete stop. Of course, plenty of practice helps, too, but it really isn't that difficult.



• High-speed handling

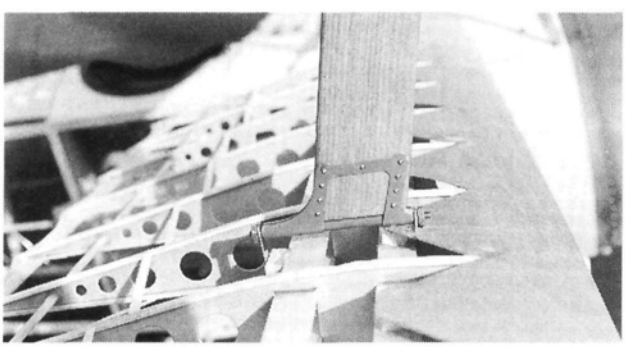
The full-scale triplane was not noted for its speed; in fact, with a top speed of only 110mph, it was slower than most planes of its day. When it needed speed in combat, it achieved it by gaining altitude and then diving toward its prey. Scale speed for the model should not exceed 30mph. With the O.S. 120 engine, this means flying at half throttle. When diving for high-speed flybys or accelerating to full throttle, no trim changes are necessary, and control response is positive.

• Low-speed handling

With a generous wing area and a light weight (only 15 pounds), the triplane has very impressive low-speed maneuverability that makes its low-speed characteristics outstanding and its stalling characteristics almost negligible. I have yet to experience any stalling tendency, even at the slowest speeds.

• Aerobatics

During WW I, the triplane's superior maneuverability in combat was one of its greatest assets; it could out-fly its adversaries in any fierce dogfight. This makes it a natural for aerobatics. A flip of the switch to the high-rate aileron setting on the transmitter allows it to do very impressive axial rolls without rudder input. Before entering large, graceful loops, a slight dive is necessary, but there's no tendency whatsoever to fall out at the top. Stall turns, Immelmanns and split-S's are also an impressive part of the triplane's aerobatic repertoire. Whether it's a model or full-scale replica, seeing a triplane perform has always been exciting for me. This is especially true when it's a model in the hands of expert Top Gun modeler Roy Vaillancourt. Thank you, Roy.



The outer wing-strut aluminum fittings are machine-cut.

The aileron control hinges are exactly to scale.

• Color chips for standard Fokker Flugzeugwerke camouflage; dry-transfer decals (e.g., manufacturer's place, spar date box).
• All parts identified and/or packaged in numbered "zip-lock" bags.

MID-WING CONSTRUCTION

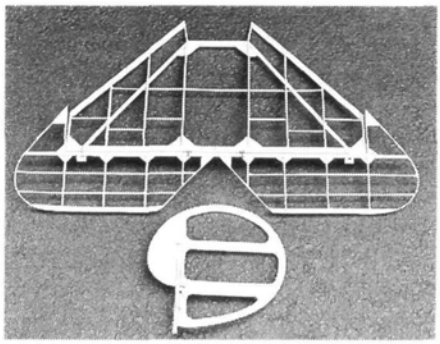
The four U-shaped spruce spars must be spliced at a 45-degree angle where illustrated on the plans. The spars are then joined with carpenter's glue as are the plywood doublers inside the spars. The spars must be flat and straight because they are the heart of the wing structure.

When the glue joints have cured (overnight), 1/8-inch screw holes for the wing fittings are drilled where shown in the construction manual and on the plans. It's important to take the necessary time to mark the positions exactly, because there's no room for error here. When the wings have been built, an error here would be virtually impossible to correct. Temporarily mount all the outer strut brass fittings on the two wing spars with 2-56 machine screws and blind nuts (as shown on the plans), and be sure they're properly aligned.

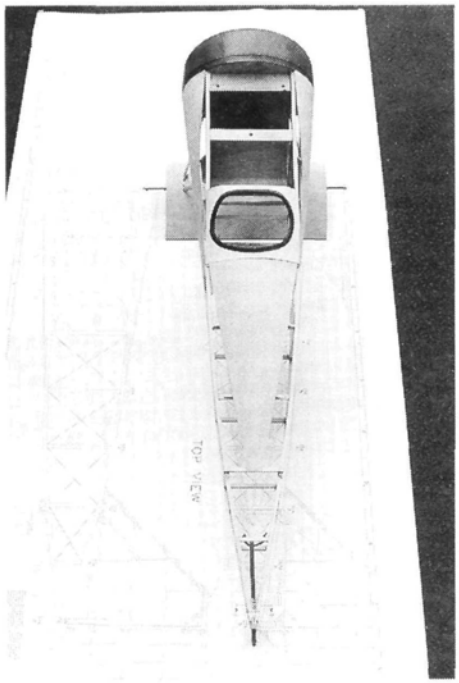
When the alignment is complete, remove all the fittings and screws and set them aside. They will be added later when the wing is completed. At this time, the blind nuts in the spars are all glued into place using CA; be careful not to get any glue on the blind-nut threads.

The 1/32-inch-thick plywood ribs (no. 20) must slide freely onto the two U-shaped spars and must not make the ribs bow or become distorted. A light sanding along the entire spars with 80-grit sandpaper will be required. The two 1/4-inch-thick basswood inner ribs (no. 22) are slid into position on the spars as shown on the plans; then, following the plans, the 16, 1/32-inch-thick ply ribs are slid onto the spars (but not glued yet).

All the ribs have lightening holes cut out exactly as they were cut on the full-scale triplane. An 1/8-inch-diameter dowel (no. 47) is slid through the last hole in each rib. The entire wing assembly is then placed on the plans, and all the ribs and spars are aligned exactly as shown on the plans. Ensure that all the ribs are straight and at 90 degrees to the spars. When alignment is complete, pins are carefully pushed through the spars and into the building board; double-check to ensure that the alignment hasn't been disturbed. Then 1/16-inch-thick balsa scalloping (no. 61) is pinned into place on the assembly. Using CA, all the ribs are glued to the spars, the dowel and the balsa trailing-edge support.



The completed elevator, stabilizer and rudder.



The top view of the completed fuselage along with full-size drawings.

To ensure that the outer wing struts are of true scale width, spar extension blocks (no. 53) are added to the back of the rear spars at the positions shown on the plans. Leading-edge balsa sticks (no. 52) are then positioned and glued to the leading edge of each rib. The brass assembly fittings, which had been trial-fit to the spars before constructing the wing, are now permanently fit to the spars.

The wings are removed from the plans, and the balsa leading edge is sanded to the proper contour.

The top of the triplane's leading-edge wing sheeting has a saw-tooth pattern. The kit includes a leading-edge outline sheet that's used to cut a saw-tooth pattern out of the 1/64-inch-thick ply leading-edge sheeting (no. 7). This is accomplished by sponge-wetting the sheeting, placing the pattern on top and using a sharp scissors to cut out the pattern as shown.

Support blocks (no. 18) are glued to the top of the front spars between each rib. They support the leading-edge sheeting on the top of the wing.

Starting at the bottom and bending it upward toward the top, the leading-edge sheeting is once again sponge-wet on the outside and wrapped around the front of the wing panel. It is helpful to spot-glue the sheeting to the bottom of the ribs to prevent it from moving while you bend it. Before gluing, secure the sheeting with 1/2-inch-wide masking tape. When the sheeting is in place, Zap* is applied to all points of contact between the wing ribs and the leading-edge sheeting.

Cut 1/8-inch-diameter bamboo (no. 204) and glue it along the entire length of the balsa trailing-edge scalloping support to give a true, scale effect after the wings have been covered.

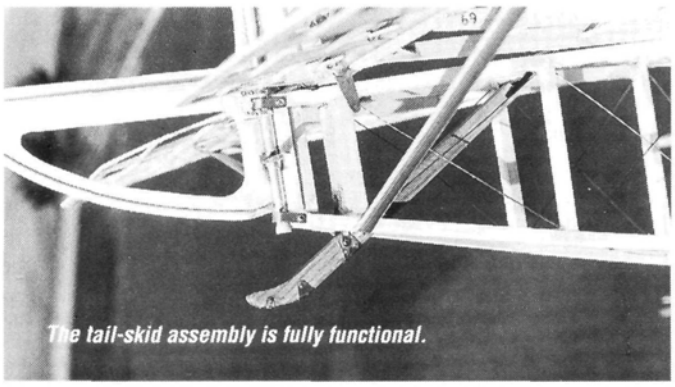
When in its correct position, each wingtip is slightly arched. To achieve this, each wingtip should follow and be glued to the center line of the outermost wing rib.

Rib capping is the last procedure. The rib capstrips (no. 26) must be perpendicular to all the ribs, including the wingtip rib.

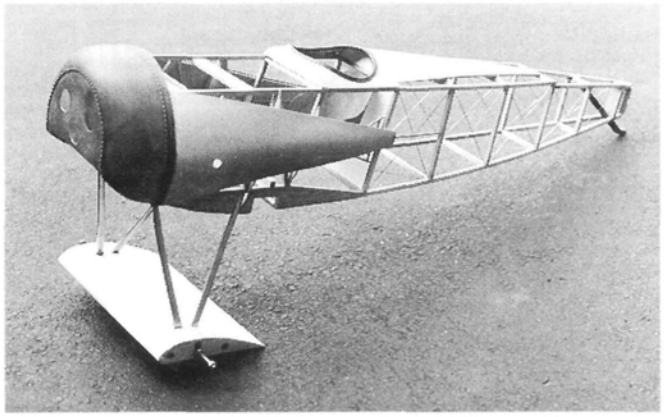
All the wings, including the sub-wing (part of the landing-gear assembly), are constructed in basically the same way as the mid-wing, which has been discussed in detail here.

The ailerons for the top wing are made separately from the main wing panels and are built directly on the plans. Balsa ribs, bamboo scalloping and 9/32-inch-diameter aluminum-tube leading edge make up the aileron assembly. Great care must be taken when assembling the brass aileron control horns. An excellent silver-solder joint must be made between the inside of the brass control horn (no. 303) and the center of the control-horn fastener (no. 717). To ensure that there are no errors in this important procedure, the construction manual covers this in great detail.

The stabilizer, elevator and rudder are basically of stick-and-rib construction and are also assembled directly on the plans. Great care must be taken when assembling the control horns for the rudder and the elevator.



The tail-skid assembly is fully functional.



The completed fuselage with the gear struts and the cowl in place.

FUSELAGE

The fuselage is made of 1/4-inch-thick spruce longerons, 1/4-inch-thick spruce vertical and horizontal members and 1/8-, 7/16- and 3/8-inch-thick balsa formers. One-eighth-inch-thick spruce stringers are used to support the triangular, 1/64-inch-thick ply, top rear-deck sheeting. Spruce stringers are also used to support the triangular sheeting for the sides. To achieve the correct prop-to-cowl clearance, you must decide on your engine before you epoxy the 1/4-inch-thick-ply firewall into place. An O.S.* Gemini 1.6ci twin was used in the prototype, and the plans show the firewall location for that particular engine.

The engine used for this review is the O.S. 1.20 Surpass II (with a pump) mounted upright.

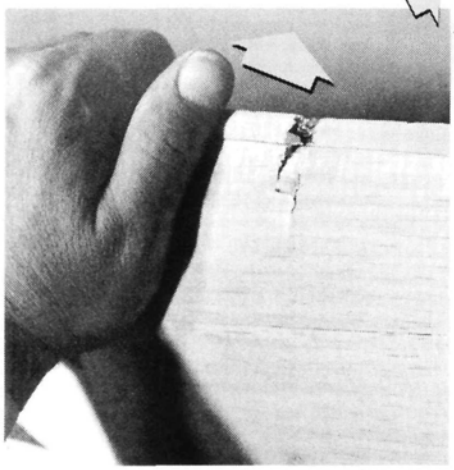
When the fuselage is complete, the stabilizer is secured to it by three, 2-56 machine screws and nuts. The lower wing is secured to the fuse with one 8-32 Allen-head machine screw and a blind nut. The mid-wing is mounted with three 8-32 screws and blind nuts.

FUSELAGE UNDERCARRIAGE ASSEMBLY

Four pre-bent aluminum struts make up the undercarriage. They are first mounted to the sub-wing and then to the fuselage with wood screws. A problem arose in this area when the struts were fit to the fuselage as shown on the plans and described in the manual. The two, rear, undercarriage struts prevented the bottom wing from being mounted on the fuselage. In a phone call to Glenn Torrance, he explained that the two inner ribs that cradle the side of the fuselage had to be slightly trimmed to make enough clearance to allow the wing to fit. After thoroughly studying the situation, I decided that trimming the ribs as suggested might weaken the wing. Instead, I

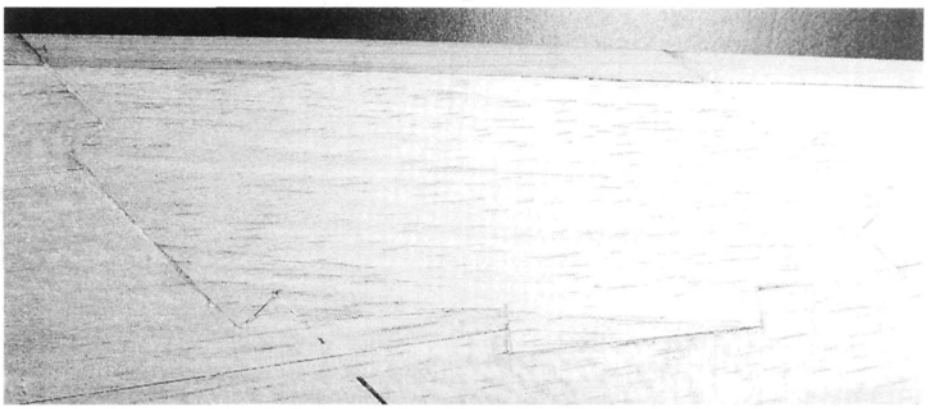
(Continued on page 120)

HOW TO



Repair Foam-Core Wings

BY ROB WOOD



Easy fixes for like-new strength, weight and performance

THERE WAS A time in the not-too-distant past when every R/C model airplane was built of balsa. Balsa is light, strong, easy to work with and is still the material of choice for many builders. In the past several years, however, wings of balsa-sheeted foam-cores have begun to appear on the modeling scene with greater frequency, bringing with them their own particular engineering problems.

The first question the modeler needs to ask when contemplating the repair of any wing is whether or not the wing is worth repairing. One of the arguments heard quite often is that a wing is never as straight or as strong after major repairs and that repairs invariably add weight to the airplane. It may be true that a severely damaged wing may require more effort to repair than building a new wing; however, most of the damage one is likely to incur is quite repairable, and if certain precautions are taken during the repair process, the wing can be restored to service with very little weight gain.

WHY USE FOAM FOR WINGS?

Before repairs can begin, it's important that the modeler understands some of the properties of foam, and how (and why) it is used in wing construction.

Expanded polystyrene foam is the lightest construction material available to modelers (typically, 1.5 pounds per cubic foot). Although very low in tensile strength (resistance to pulling forces) and torsional strength (resistance to twisting forces), it does have a fairly high compression strength (resistance to crushing) which, when it's enclosed in a wooden structure, helps the foam to maintain the shape of the wing. Foam is composed of multitudes of air-filled cells (beads) fused together by heat. It has no grain or fibers to lend structural integrity to its span, but this same lack of grain contributes to another excellent property that's useful for aircraft construction: dimensional stability (resistance to warping, shrinking, etc.). Using foam also simplifies wing design and speeds up fabrication; only two rib-like templates, necessary for cutting the foam to shape, need to be made.

The foam-core provides and maintains the shape of the wing, and it's vitally important to keep this in mind when making repairs. If the shape of the core is altered during the process, the airfoil in the repaired section is altered as well, possibly resulting in unpredictable flight characteristics.

The strength of a foam-core wing stems from its being enclosed in a "box" that consists of a frame (balsa leading and trailing edges, wingtips and a plywood root rib) that's sheeted with balsa or thin ply. In addition, foam-core wing halves often utilize full-span spars that are joined at the wing center section. When the box components are locked together and glued to the cores, the wing is very strong and has crush-resistant skins. It is this box-like structural integrity that any repair effort must address. If the integrity of the box is compromised, the wing will become weak and may very well fail in flight.

Note: this article describes one approach to the repair of a leading-edge section; it's typical of the damage incurred in a midair collision or in an encounter with a fence post. Although there may be other approaches that would work as well, the procedure outlined here has worked well for the author.

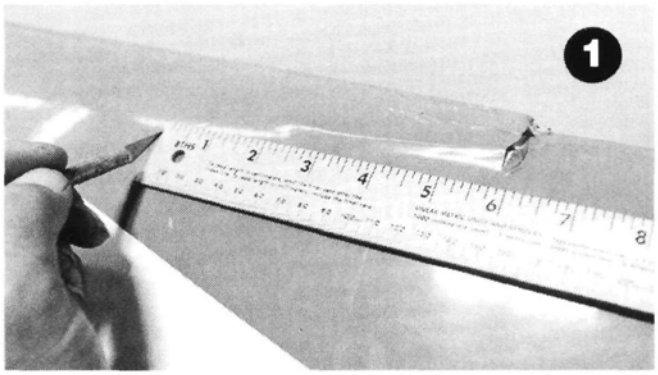
REPAIR PROCEDURE

Typical damage to this type of wing involves cracked or splintered balsa sheeting, cracked or broken balsa leading or trailing edges and creased or pulverized foam. Often, the basic shape of the wing is maintained, even in cases of severe impact, and although this feature of balsa-sheeted foam wings is one of its best selling points, the unique properties of polystyrene foam require special techniques for proper repair.

WHAT YOU'LL NEED

- **TOOLS.** X-Acto knife handle, fresh no. 11 blades; Master Airscrew* balsa stripper (or a homemade version of it); various sanding blocks; 80-, 220- and 320-grit sandpaper; adjustable bevel gauge or protractor; razor saw; fine-tip felt pen; accurate tape measure; steel rule or steel straightedge; Easy Mask painter's tape; wax paper; and finishing materials. A Dremel tool with a router base is optional.
- **MATERIALS.** Balsa sheeting; leading- and/or trailing-edge stock; polystyrene foam of the same density as the wing-cores; and the original foam wing-core saddles (if available).
- **ADHESIVES.** Yellow or white wood glue; non-foam-reactive CA, such as thick and thin UFO*; and 30-minute epoxy.

1. DETERMINING THE EXTENT OF THE DAMAGE



1. If your wing is covered with plastic film, you will have to remove the covering that's over the damaged area. Carefully slice the covering 3 inches past the ends of the damaged area, all the way around the wing. Avoid slicing into the balsa sheeting.

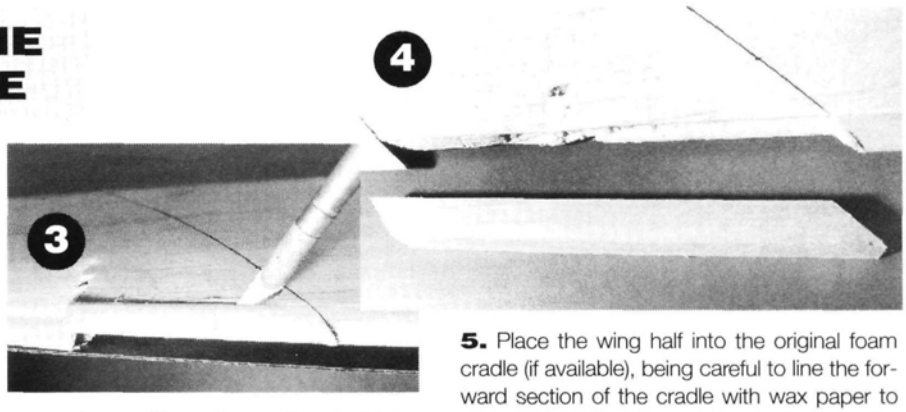
2. Gently twist the wing while examining the sheeting and the leading and trailing edges. Damaged balsa may appear intact until it is twisted; twisting may reveal hairline cracks. Mark the cracks lightly with a felt-tip pen. If cracks run under the covering, strip more of it away. Repeat this procedure for the wing bottom. Make sure that you have at least 3 inches of undamaged wood revealed on either side of the damaged section.

2. REPAIRING THE LEADING EDGE

General note: "butt" joints for repairing damaged wing structures are not recommended. All joints should be either beveled lap joints (two ends joined with an overlapping angle) or interlocking joints.

The damaged area illustrated here is between the root and the tip and was incurred when striking a fence post during a bad landing. The trailing edge is intact, but the leading edge, sheeting and foam is crushed. Our first goal is to restore the integrity of the leading edge.

1. Draw a line that extends at a 45-degree angle from the front of the leading edge to the trailing edge, angling it toward the damaged area. Begin this line approximately 2 inches inboard from the farthest limit of damage, and draw another line that's parallel to the first approximately 2 inches outboard of the damaged area. Then draw a line that intersects these two lines, is parallel to the leading edge and is approximately 2 inches to the rear of the farthest limit of the damaged sheeting. Repeat for the bottom of the wing.

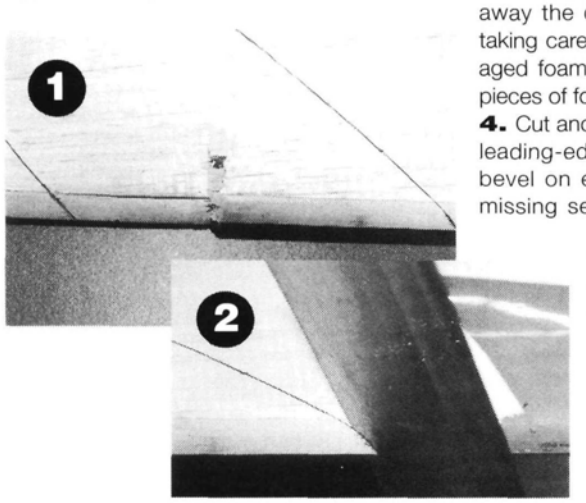


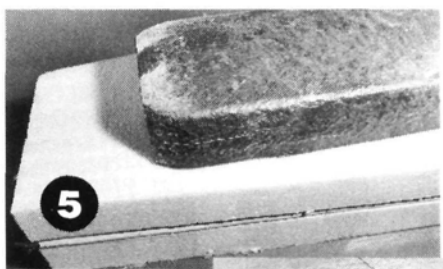
2. Using the razor saw, carefully cut the leading edge along the lines. Avoid cutting into the foam or the sheeting.

3. Using the X-Acto knife, begin slicing away the damaged leading-edge section, taking care to avoid cutting into the undamaged foam or sheeting. Pick out any loose pieces of foam from the damaged core.

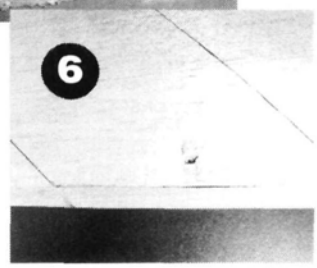
4. Cut and roughly shape a piece of straight leading-edge stock that has a 45-degree bevel on each end. This will replace the missing section. Make sure that the total leading-edge length of the repaired wing half equals that of the undamaged wing half! The top and bottom of the piece should match the radius of the undamaged leading-edge sections. Test-fit the piece and, if you're satisfied, glue the new piece into place.

5. Place the wing half into the original foam cradle (if available), being careful to line the forward section of the cradle with wax paper to prevent the wing from sticking to it. Place the whole assembly on a flat surface, and weight the top cradle. Let the wing cure overnight in the cradle. This procedure ensures that the repaired leading edge will be straight. If the original cradles aren't available, clamp the leading edge of the wing between two straight pieces of hardwood.

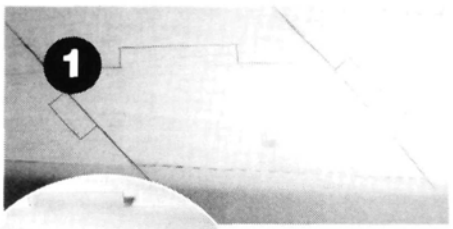


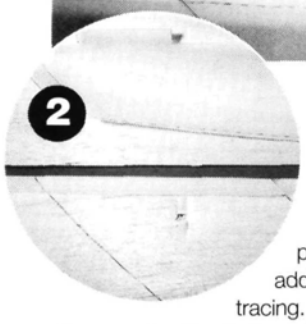


6. After the joint has cured, trim and sand the leading-edge section to match the undamaged sections.



3. REMOVING DAMAGED SHEETING



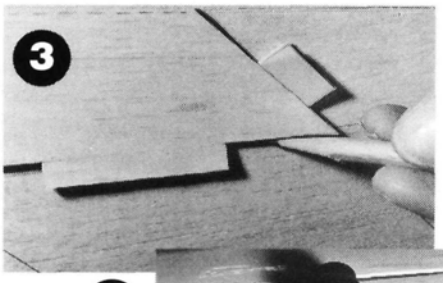


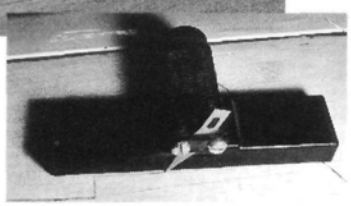
1. Tape a piece of tracing paper over the damaged area. Trace the box shape you had drawn in the previous steps, but add square tabs to the tracing. The tabs will lock in the new sheeting to the existing skin.

2. When you're satisfied with the design, transfer the drawing to new sheeting stock, and cut out the shape.

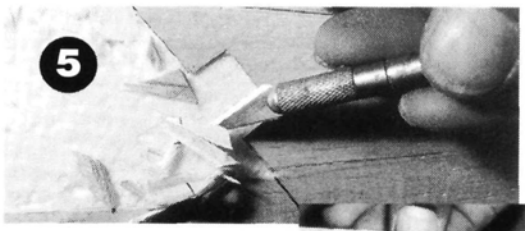
3. Lay the finished replacement sheeting over the damaged area of the wing, and trace the pattern onto the wing.

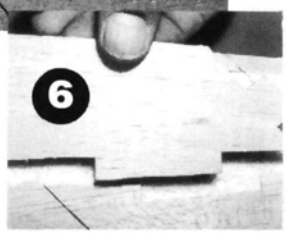
4. Set the depth of cut for the Master Airscrew balsa stripper (or a homemade version) to equal the thickness of the existing sheeting, and cut out the marked shape.





5. Carefully pry the damaged sheeting away from the foam. If epoxy was used to glue the wing sheeting to the foam-cores, the sheeting may tend to pull foam out of the core as it's lifted. If so, you'll have to sand the damaged sheeting away from the foam. An alternate method that works well is to use a Dremel with a router base and a straight cutting bit. Set the depth of the cut to equal the thickness of the wing sheeting, and carefully remove the damaged section. You'll have to cut out the corners of your outline with a razor knife, but you'll have a clean expanse of foam to which you can glue the new section.



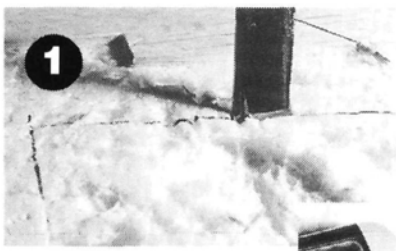


6. Test-fit and trim the new sheeted section until it fits tightly into the prepared area of the wing. Repeat this procedure on the other side of the wing. Wick thin, non-foam-reactive CA into any hairline cracks in the existing wing sheeting, and set the pieces aside.

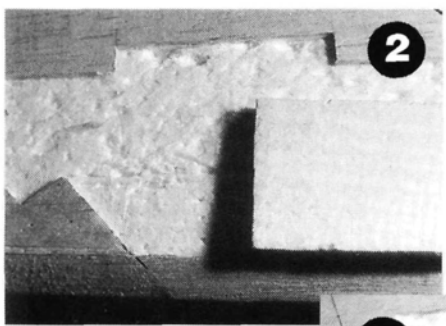
4. REPAIRING THE SPAR

Examine the revealed core section. If a spar runs through this section, remove the foam from around it, and examine the spar. Gently twist the spar, and check it for cracks. If the spar has hairline cracks that run longitudinally, you may be able to clamp it and wick thin CA into the crack. The ideal repair, however, is to glue the break and glue a scab piece of spruce or aircraft ply over it. Extend the scab approximately 1½ inches past the break at both ends. You'll have to use your own judgment.

5. REPLACING DAMAGED FOAM

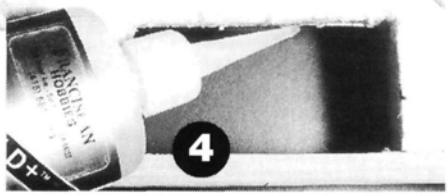


1. Using a felt-tip pen, carefully draw a rectangular mark around the damaged foam section. Using a sharp knife with a long blade, carefully cut away the foam. Follow the marks, and try to make the cut as perpendicular as possible, all the way through the wing. Remove the damaged foam.



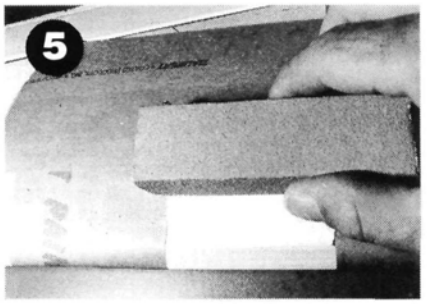
2. Cut a new piece of foam to a size that matches the hole, but make it approximately ¼ inch thicker than the thickest section of the hole. Test-fit the new piece; it should slide easily into the hole without binding.

3. Using the felt-tip pen, mark the airfoil shape on all four sides of the foam block by laying the pen against the surface of the surrounding wing and running the tip all the way around the block. Repeat the marking procedure on the bottom of the wing. Carefully cut and sand the repair block to match the lines, taking care to leave about 1/16 inch of excess material beyond the lines. You will sand this excess away after you have installed the block. Test-fit the shaped block.



4. Apply a thin coat of wood glue, non-foam-reactive CA (slow curing), or 30-minute epoxy to the inside edges of the hole, and carefully insert the new foam section. Wipe away any excess, and allow the glue to cure.

5. After the new section has cured, mask off the wing surface that surrounds the new section with Easy Mask. Using a block sander



with fine-grit paper, carefully sand the remaining 1/16 inch of foam until you begin to sand through the Easy Mask. Remove the masking and, using the finest grit paper available, feather the edges of the new section into the surrounding area.

6. INSTALLING NEW SHEETING

1. Test the new sheeted sections for a final fitting. Trim as needed.

2. Apply wood glue or 30-minute epoxy to the new sheeted sections at all points of contact with the prepared wing sections. Fit the sheeted section into place, and wipe off any excess glue.

3. Line the foam wing saddle with wax paper, and place the damaged wing in the saddle. Weight the saddle on a flat surface while the repair cures.

4. After final curing, remove the wing from the saddle. Lightly sand the newly sheeted sections with 220-grit sandpaper until they blend satisfactorily with the surrounding wing surfaces. The wing is now ready for finishing.

7. FINISHING TOUCHES

If your wing is covered with plastic film, remove any sanding dust with a tack cloth, and recover the exposed section. This approach will result in a quick finish, although you'll have a seam at each end of the repaired area. For a finish that will result in a invisible repair, strip all the covering back to the wing center section, and apply a seamless covering.

You now have a wing that's virtually as strong as the original and weighs just about the same. Only by adding a scab to the spar would there be a measurable weight gain, and if you followed the instructions carefully, your wing should be straight and true.

**Addresses are listed alphabetically in the Index of Manufacturers on page 153.* ■

MonoKote Design Contest Winners!

Sponsored by Top Flite and *Model Airplane New*

THE Top Flite MonoKote Design Contest sponsored by Top Flite and *Model Airplane News* has generated a terrific response; over 900 entries have been received! The contest offered over $4,600 in merchandise prizes from Top Flite, Great Planes and *Model Airplane News,* with a Grand Prize worth up to $2,000. The top 15 winners are shown here, and all 50 winners are identified.

Judging this contest was no easy task, but careful attention to contest criteria and a thorough and detailed review of all the entries helped the editors meet the challenge of identifying the best of the best.

Among the judges was contributing editor Faye Stilley, author of one of our best-selling books, "Covering R/C Airplanes." Faye, who is about to complete a technique-packed Volume 2 of this work, has won many top honors at the Toledo and WRAMS trade shows because of his MonoKote artistry. (Faye took first place, MonoKote, in four of the last five annual Toledo contests.) We are pleased to include Faye's commentary on the top five winners of this exciting competition.

As noted on each entry card, judging was based on the following criteria: designs must...

- **Show effective use of color;**
- **Enhance the appeal of the airplane;**
- **Complement the airplane's design;**
- **Be unique, creative and innovative;**
- **Be easy to reproduce for the average modeler.**

We congratulate all the winners and thank the many hundreds of entrants whose participation made this great contest possible. Now take a look at these winning designs!

GRAND-PRIZE WINNER

The Grand-Prize winner is **Kevin Pohlman** of Fort Lupton, CO. His Great Planes Super Skybolt is a study in covering excellence. Kevin has won the Magnificent Airplane Package—up to a $2,000 value—which includes his choice of any Great Planes Mfg. or Top Flite kit and its recommended engine, *plus* a Futaba 7UAPS PCM radio, all the recommended building accessories, up to six rolls of MonoKote and a complete assortment of covering tools.

Faye Stilley: *Kevin's design is well-thought-out, which is clear from the size, shape and fit of the graphics to the contours of the aircraft. He took an attractive airplane and made it more attractive by blending color with form. In my opinion, it looks better than the original, full-scale airplane. He achieved a design that's elegant in its simplicity. It met contest critieria in all respects. I think that we will see this design and versions of it many times in the future. This MonoKote design also shows that you can have a unique-looking airplane when working with only three colors.*

FIRST-PLACE WINNER

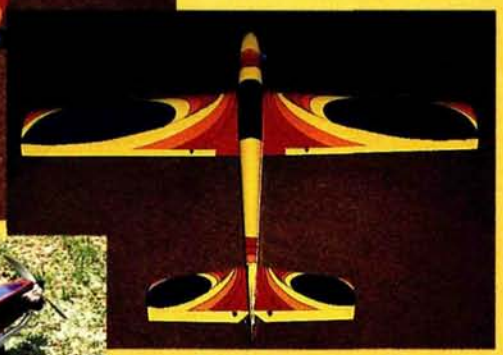
First prize—a complete MonoKote package of 49 colors worth over $750—was won by **Joseph L. Orosz, Jr.,** of Orlando, FL. Joseph submitted this eye-catching, modified, '60s-vintage Sterling Wizard.

Faye Stilley: *Joseph took the components of many designs that we've seen before and took them a step further. For example, a traditional starburst design was modified into a kind of feathered-wing design. He embellished this pattern with trailing-edge scallops and a leading-edge color band. The red, white and blue color scheme flows smoothly and consistently over the entire aircraft—including the wheel pants. It shows artistic ability and careful planning.*

SECOND-PLACE WINNER

Second prize—a complete trim graphics and covering-tool package with a $350 value—was taken by **Tim Colbert** of Winter Springs, FL, with his Ace 4-120 that was customized to resemble an Ultimate.

Faye Stilley: *Tim used pearlescent colors on a dark background to complement the shape of the aircraft. The color sequence—Pearl Red, Pearl Wine, Pearl Teal and Pearl Copper is repeated throughout the graphic design. The light-reflective pearlescent colors seem particularly radiant against the deep black background. The visually appealing color-overlay design cleverly ties the wing color scheme to that of the tail group.*



THIRD-PLACE WINNERS

Our two third-place winners each receive a library of Air Age Publishing model airplane books—15 comprehensive "how-to" R/C airplane works worth over $120. The first third-place winner is **Gene Trujillo,** of Albuquerque, NM, who submitted this unusual, but eye-opening, covering design on his Model Tech Calypso.

Faye Stilley: *Gene enhanced the appeal of his airplane and complemented its appearance. He created an exotic-looking airplane out of a relatively standard pattern design. The color scheme is evocative of tropical colors—blending hot reds and yellows with cool blue. It shows a creative use of elliptical shapes on rectangular surfaces, which totally changes the overall appearance of the aircraft.*

Bobby Mills, of Pensacola, FL, also won third place with this beautiful Great Planes Patriot.

Faye Stilley: *Bobby clearly chose a theme before beginning to cover, and he carried out the execution of that theme well. The sizes and proportions of the graphics were altered to fit the various surfaces. The theme—speed—goes well with the Patriot design. It makes the airplane look as though it's in motion even when it's at rest. The rich and appealing, but not overly flashy, color selection is appropriate for the theme.*

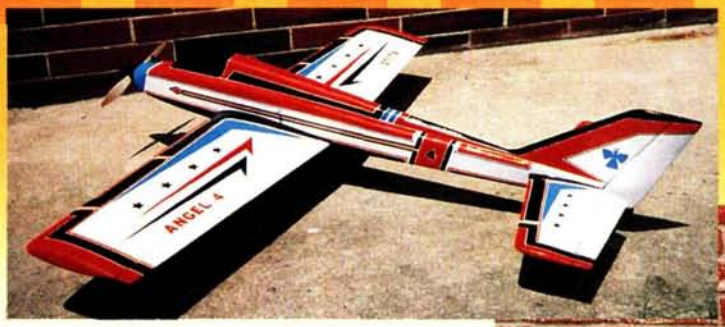
FOURTH-PLACE WINNERS

All fourth-place winners receive a 1-year subscription to *Model Airplane News.*

Daniel D. Anderson, Salem, OR—Super Skybolt Biplane.

Right: Darren Ulrich, Hickory Creek, TX—Great Planes Ultra Sport 40.

Right: Kim C. Marshall, Tempe, AZ—Ohio R/C Ultimate Bipe.



Mike Cooper, Sparta, NJ—Oriental.

Above:
Mike Cramer, Mountville, PA—Angel 4 (owner's design).

Right:
Steve Chiu, Sugarland, TX—Great Planes Super Sportster 40.

R. Gary Dennison, Blue Point, NY—Great Planes Ultra Sport 1000.

Left:
Albert S. Tatka, Franklin, NJ—3.25 Extra (from Rich Uravitch plans).

Art Marcyan, Oakdale, MN—Carl Goldberg Ultimate Bipe.

Marc Landry, Caraquet, N.B., Canada—Carl Goldberg Tiger II.

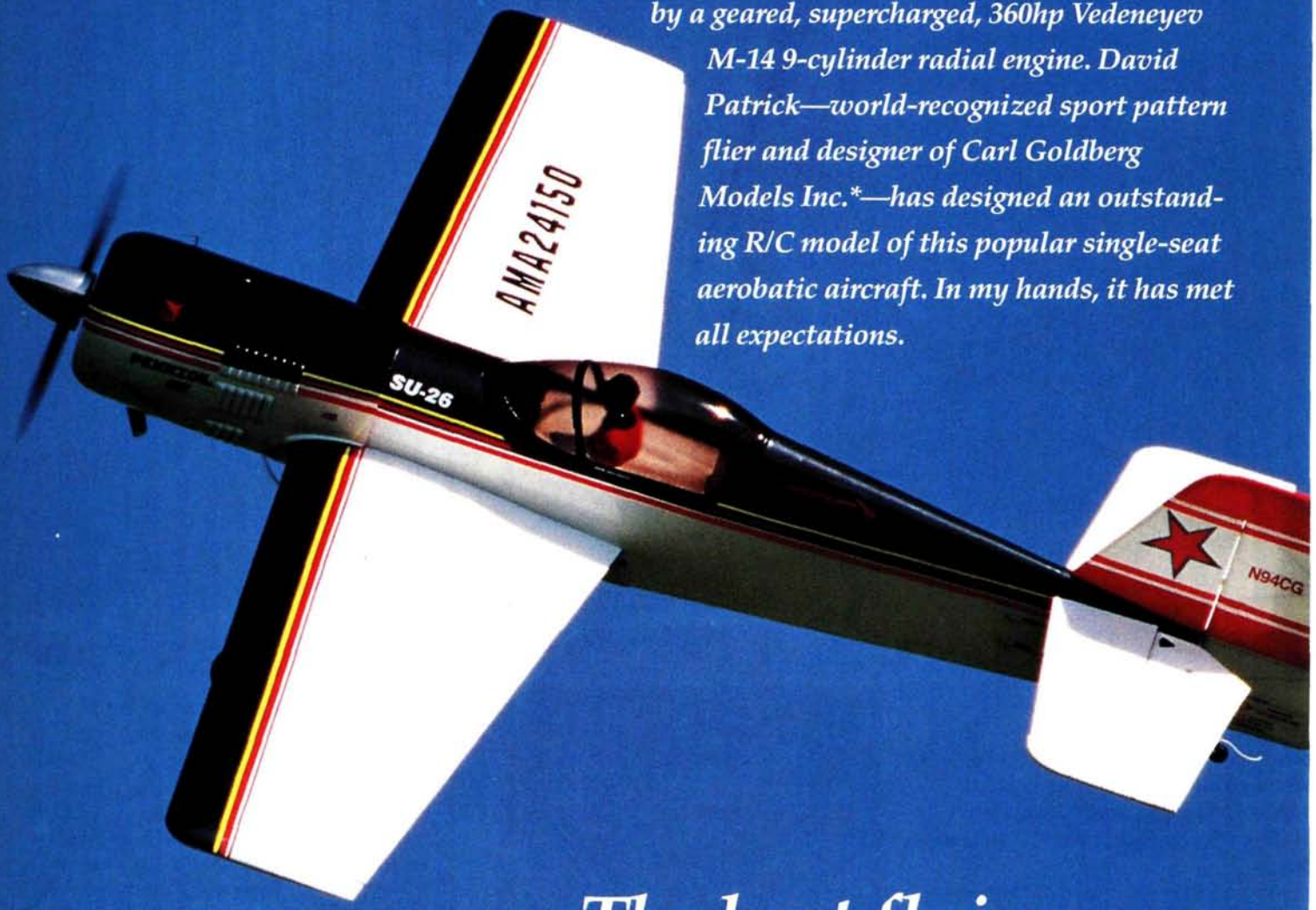
FIFTH-PLACE WINNERS

Fifth-place winners each receive a Top Flite magnetic prop balancer. Retail value: $27 each.

Kevin Howell, Antioch, CA; Duane Burns, Denison, TX; Richard L. Stewart, Newark, DE; David Ferguson, Oklahoma City, OK; Raymond S. Sorensen, Centerville, OH; Eric Beard, Olney, IL; Jeffrey Stremick, Walhalla, ND; Jim Kramer, Ames, IA; Michael Ben-Shabat, Jerusalem, Israel; Michael Ramsey, Rockaway, NJ; A.W. Nelson, Grants Pass, OR; Robert D. Lathrop Jr., Moorestown, NJ; Thomas Marty, Plover, WI; Bill J. Tuger, Morgan City, LA; Brad Weissenfels, McPherson, KS; Elfriede Lake, Enderby, B.C., Canada; James C. Gillikin, Bastrop, LA; Richard L. Madewell, Munford, TN; Ken Jeschke, Hepburn, Saskatchewan, Canada; Alajos F. Fiel, Prospect Park, PA; Glen Tremaine, Muncie, IN; Ted Carl, Wayzata, MN; Brian Chapman, Broken Arrow, OK; Dan Mioduch, Westland, MI; Tim Losito, St. Louis, MO; Alan Ruben, Collierville, TN; Russell H. Lynch Jr., Westerly, RI; Carlos Rivera Sanchez, San Sebastian, PR; Robert A. Garner, Jr., Proctorville, OH; Roman L. Zwolski, Ripon, WI; John Evans, Littleton, CO; Susan Loomis, Acampo, CA; James C. Smith, Thonotosassa, FL; Jarvis D. Justus, El Monte, CA; Charles A. John, San Angelo, TX.

FIELD & BENCH REVIEW

THE SUKHOI 26M (SU-26) prototype first flew in June 1984, and it took part in the World Championship in Hungary in August 1984. Russian pilots flew the SU-26 through 1986 and won 61 championships. The original SU-26 had titanium alloy wing ribs, main gear, and an exhaust system, and it was powered by a geared, supercharged, 360hp Vedeneyev M-14 9-cylinder radial engine. David Patrick—world-recognized sport pattern flier and designer of Carl Goldberg Models Inc.—has designed an outstanding R/C model of this popular single-seat aerobatic aircraft. In my hands, it has met all expectations.*

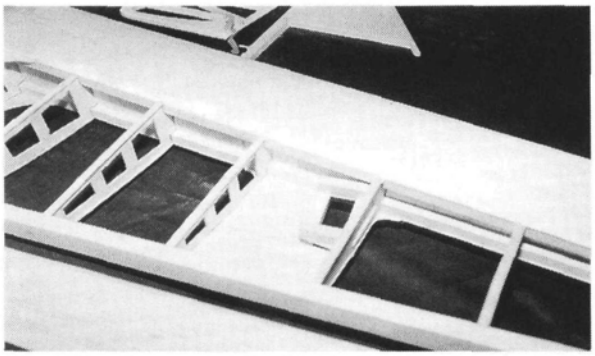


The best flying SU-26 west of Moscow!

SUKHOI

Carl Goldberg Models

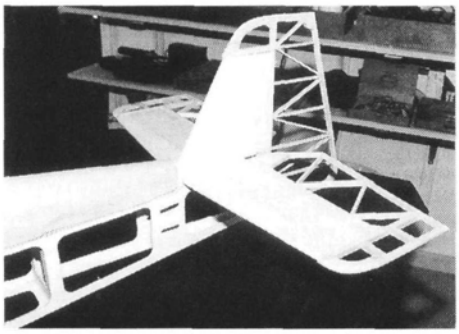
by RON FAANES



The aileron servo mount in place in the wing. Note the lightweight rib design and shear webbing on the main spar.

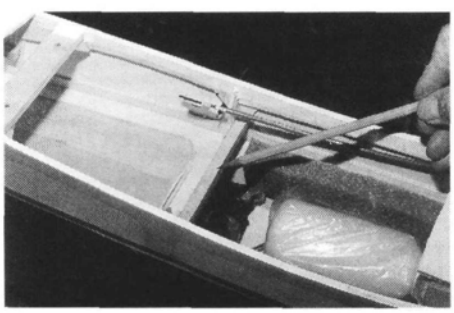
THE KIT

The SU-26 was my first Goldberg kit in 20 years of building R/C models. In the first-run kits, some stringers were missing, and there were discrepancies between the plans and the instruction booklet, which, I might add, is superbly done, even with the mistakes. The Goldberg folks were very helpful and readily available on the telephone (800-6-Flying) when questions and/or clarification were sought. I evaluated a later kit and found that the mistakes had been corrected.



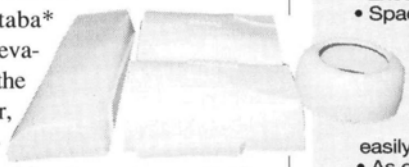
Here's the completed tail section. To simplify construction, I used balsa blocks to fill in the aft section of the turtle deck.

The kit includes all the required die-cut and shaped wood (well-marked to minimize the builder's labor); a complete hardware package; a canopy; formed landing gear; a four-piece, white, plastic cowl (the assembly of which will be discussed later); a belly pan and decals. Also included in the parts list is a nylon-reinforced Goldberg engine mount. Two large plan sheets show full-size construction details, and a well-illustrated 49-page manual and a booklet on the basics of radio control are part of the kit. Not included in the kit are: engine, prop, fuel tank, fuel tubing, wheels, pilot figure, adhesives, covering materials and, of course, the radio.



To make the servo tray removable, I installed this 3/8-inch-square hardwood piece and secured the tray to it with screws.

Because a servo is placed in each wing panel for aileron control, five servos are required. For insurance, I used two servos for the elevator, which brought the servo count in my SU-26 to six. I used JR* L 4001 servos for each aileron, Futaba* FP9201 for the elevators, FP131s for the throttle and rudder, and a 3-inch Tru-Turn* spinner, which is the size indicated on the plans.



The four-piece plastic cowl and the belly pan included in the kit are a bit difficult to assemble.

CONSTRUCTION

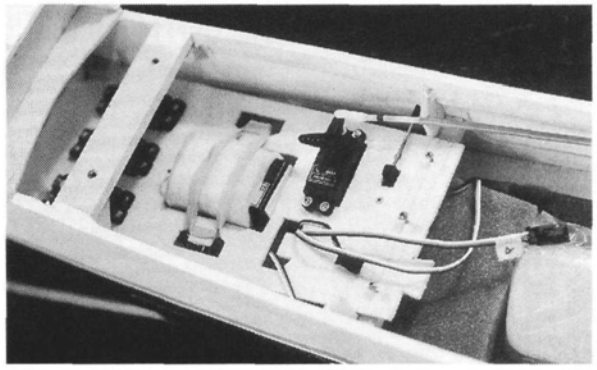
After reviewing the plans and the instruction manual, I started the building sequence with the horizontal stabilizer, which is straightforward. The leading-, and trailing-edge 1/4x5/16-inch balsa and 1/8-inch laminated balsa tips were laid out on wax-paper-covered plans and placed on an Eldon J. Lind* Magic Magnetic Builder. Once trussing was in place, the frame was sheeted with 5/64-inch balsa.

The rudder and elevator were built up in two sections in identical fashion, but they weren't sheeted. It wasn't highlighted in the building sequence, nor was it obvious that the design requires a 1/4x5/16-inch tail-post reinforcement on the lower half of the vertical stabilizer's trailing edge. This omission was noted after the sheeting had been completed, and it's easily rectified by cutting a slot of the appropriate size in the bottom stringer and slipping it in. The 5/64-inch sheeting saves weight and was easy to work with. A warning to future builders: utmost care must be taken when handling the 5/64-inch sheeted surfaces; they're very easy to accidentally puncture—a major frustration.

• **Wing.** The explicit instructions direct the builder to cut the wing panels out of the plan and tape them together at the alignment arrows. As my building area was limited, I felt the wing panels could be built separately. Big mistake! After building each separately, I encountered alignment problems when I joined the two panels.

The plans direct the builder to notch the leading edge for the wing hold-down dowel. Thinking it would be easier to drill a hole after the wing had been located in its saddle, I didn't follow the instructions. Securing the dowel can be done either way; in fact, the way I did it seemed simpler.

The wing panels are built up of 5/64-inch-



Note that if the servo tray is glued into place according to the instructions, the servo-mounting screws aren't readily accessible because of their location under the wing hold-down block.

SPECIFICATIONS

Model name: Sukhoi 26M
Manufacturer: Carl Goldberg Mfg.
Type: Sport scale
List price: $249.95
Wingspan: 72.5 in.
Wing area: 949 sq. in.
Airfoil: symmetrical
Weight: 11 lb.
Wing loading: 26.7 oz. per sq. ft.
Length: 65 in.
Engine req'd: .90 2-stroke or 1.20 4-stroke
Engine used: YS 120 w/pump
Prop used: DynaThrust 15x8
No. of channels req'd: 4 (aileron, rudder, throttle and elevator)

Features: lightweight; low wing loading provides excellent aerobatic performance. Very complete kit with quality parts. Clean, die-cut, lite-ply and balsa parts fit together well. If you follow the excellent manual, this plane will go together quickly and easily.

HITS

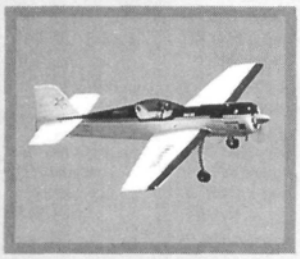
- Easy construction, lightweight.
- Stable flight characteristics.
- Very low landing speeds.
- Excellent die-cut parts.
- Spacious fuselage with easy access.

MISSES

- Four-piece ABS cowl difficult to assemble.
- Balsa sheeting very thin and easily punctured.
- As designed, the rudder and elevator servos are not easily installed or removed once the servo tray is glued in place.
- Rear of turtle deck is cumbersome to assemble; it's much easier to use scrap balsa that's sanded to contour.

FLIGHT PERFORMANCE

"Faisdodo" is Cajun for "let's have a good time." This was the word of the day when my good friends Jim Onorato and Dick Purdy met me for flight tests at Devore Air Park—home of the Westchester Radio Aeromodelers. The radio was range-checked with and without the smoke pump running according to the instructions. A final CG check was made prior to takeoff. The CG was about a ½ inch in front of the front spar—well within the specs designated in the plans.



• Takeoff and landing

The initial flight of the SU-26 was truly a memorable experience for two reasons: first, after assessing ground handling, the SU-26 was headed into a 5mph wind and lifted without control correction after accelerating about 50 feet. There was a tendency for the tail to lift during taxiing. Jim Onorato did the honors as test pilot so I could provide photographic support. Once airborne, a smooth, straight climb to test altitude followed by a right turn needed no trim adjustments. I had taken great care to adjust all control surfaces to neutral before the initial flight.

The second memorable experience of the day occurred when we were confronted with a flameout on the maiden flight because we had run out of fuel—all 20 ounces of it. This produced the unanticipated opportunity to assess powerless flight. The glide and sink rate are totally predictable. There is a tendency to roll up on the nose during landing on grass, so full up-elevator must be maintained during the rollout. The second landing under power was slow, gentle and fully under control with no sign of a tendency to stall.

• High-speed performance

The 15x8 DynaThrust propeller produced very scale speeds at full throttle. At high speed, the SU-26 handles like a pattern plane in that it goes where it's pointed. This is in contrast to its brother, the Extra 300, which, in my hands, needs control input throughout the maneuver.

• Slow-speed performance

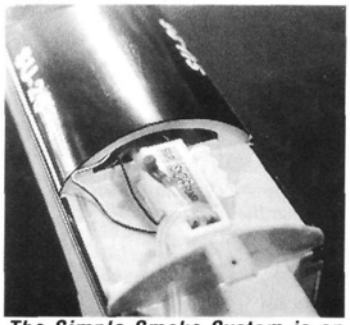
Stall tendencies were evaluated first to see whether the SU-26 would fall off to either side. At very slow speeds, it fell off to the right and recovered with increased power.

• Aerobatics

Vertical performance with the YS-120 and the 15x8 fan is outstanding. Using high-rate elevator, which provides about 1½ inches of travel (measured with a Robart* SDI Gauge), there was a tendency to fall out of the bottom of a loop. Low rate (½ inch throw) eliminated this tendency. Aileron response was slow, so the gap was sealed with strips of Ultracote, and larger control arms replaced the Futaba circular ones. The plane spins nicely, and recovery is easy and quick when controls are neutralized and power is applied. Because of the large vertical stabilizer and wide fuselage, it's easy to perform knife-edge flight. Inverted flight was easily maintained with very little elevator input.

---

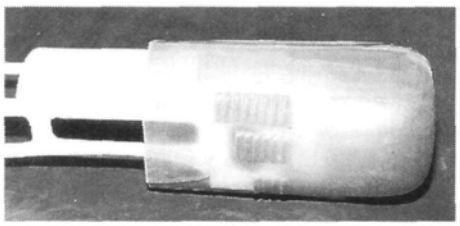
balsa, die-cut ribs/sheeting; spruce spars; solid-balsa wingtip blocks; and a formed leading edge. I used my new Precision Model Products* Balsa Edge Sander to prepare the wing sheeting. This accessory makes the troublesome task of preparing sheeting a breeze. The ailerons are built as part of the wing panel and cut from the panel prior to sanding and covering.



The Simple Smoke System is on the plywood shelf just aft of the firewall.

Wing-panel components were laid out on the plans and glued. To adjust the dihedral, the panels were joined using the builder-assembled die-cut, lite-ply jigs. It's important to identify right and left ailerons once they're cut out, because the aileron's control-horn mounts are no longer visible.

The formed, heavy-duty, aluminum landing gear is bolted to a ¼-inch-thick birch-plywood block plate that's between notched,



I replaced the kits' vacuum-formed cowl with one from Precision Fiberglass Products.

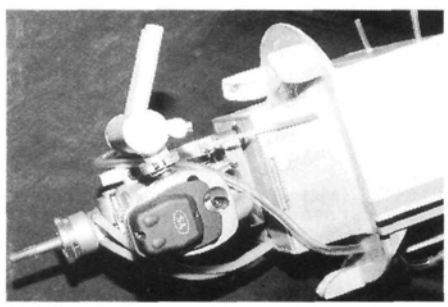
⅛-inch, lite-ply, reinforced ribs on the bottom of the wing. Blind nuts were used to secure the gear to the block. I mistook the ⅛-inch plywood landing-gear reinforcements described in the instructions for dihedral braces. Consequently, these were omitted and could not be put in as an afterthought because of the center sheeting. This is a high-stress area, and the reinforcements must be installed as described in the instructions. To my dismay, I proved this when a rollout into grass stubble dislodged the gear during the initial test flights. To ensure appropriate strength in this area, I laminated pieces of the ⅛-inch lite-ply (supplied) and epoxied them forward and aft of the block. This redesign held up through the test flights. The center section was glassed with 6-inch-wide cloth rather than the 2-inch-wide cloth supplied in the kit. I made this choice because I thought 2-inch cloth wouldn't provide the needed reinforcement. *[Editor's note: Carl Goldberg Models now includes supplemental landing-gear reinforcements kits in all Sukhoi production kits.]*

• **Fuselage.** Framing ended with the fuselage assembly. The die-cut, lite-ply sides, the bottom, the top and the formers establish a rugged, but lightweight, fuse in a remarkably short time. Assembly is straightforward and quick; the parts fit nicely; and the alignment procedure, as outlined, produces a straight, final product. It should be noted that the top of the fuselage front is cut at an angle to provide right engine thrust, so there's a correct and an incorrect way to glue it in. In my enthusiasm to get the fuselage together, I didn't pick up this important point until after the adhesive had set, and this resulted in left thrust.

The top was carefully resected and reassembled in the correct configuration. I chose to use a pre-drilled, aluminum Tatone* mount with a J'Tec* Soft Snuf-Vibe in place of the one supplied in the kit. Using the die-cut sides and the ¼-inch-thick, birch-plywood firewall, the lite-ply engine mount was assembled according to the directions.

The front, top fuselage sheeting was glued into place. I diverged from the instructions with the attachment of the turtle-deck sheeting. The plans call for assembling the empennage before the turtle-deck attachment because the turtle-deck sheeting is an integral part of the fuselage's rear esthetics. The sequence in the instructions discourages covering before assembly, which has been my building protocol.

I cut the turtle-deck sheeting where it contacts the empennage. In place of the plywood sheeting aft of the last rear former, I used scrap balsa blocks and Goldberg Model Magic, which I sanded to contour without the tail feathers. A dummy spacer temporarily replaced the horizontal stabilizer during this step. The space left behind the elevator's trailing edge and the vertical stabilizer was filled with scrap ¼-inch balsa. This



The YS 1.20 4-stroke engine has a Slimline smoke muffler installed. Note the wooden cowl-mounting brackets glued to the firewall.

modification proved to be easier than the instruction's method, and it produced a clean profile. In my opinion, it significantly reduced the time it took to align the empennage.

FINISHING AND COVERING

The Goldberg plastic hinges were installed before final sanding. This procedure is simple with the new, slick, LeRoy's Easy Hinger sold by Harry Higley*. Control surfaces were contoured to shape using the neat, builder-assembled, lite-ply gauges supplied in the kit.

I covered the SU-26 with Ultracote* because of previous experience and success. It took three rolls of white and a partial roll of black to develop the color scheme I wanted. The SU-26 is an easy plane to cover because of its flat fuselage sides, simple wingtips and absence of concave areas. When all the surfaces had been covered, I added Flame Red and Lime fluorescent Ultracote striping, which I cut using the new Custom Cut* pinstriping accessory.

I'm really pleased with the SU-26. It's very responsive, predictable and is a smooth aerobatic airplane capable of all FAI procedures.

Next came the application of the decals that were included with the kit. They peel off a backing sheet and, by first applying a thin film of deterg-ent and water to the model, you can slide the decals into position. Computer-cut graphics produced by Vinne Pin Striping* were used on the underside of the wing.

FINAL ASSEMBLY

The only remaining construction steps were the assembly of the four-piece cowl, the pushrods, the attachment of control surfaces and the installation of the radio. The receiver, the switch, the charge receptacle and the servos were mounted in the die-cut, lite-ply servo tray supplied with the kit. I cut an extra recess for the second elevator servo. If the servo tray is glued according to the instructions, the screws that secure the servos to the tray aren't accessible; they're directly under the wing hold-down block. I chose to glue a piece of 3/8-inch-square birch in front of the former that supports the servo tray, and I secured the tray with three wood screws. To keep the aft portion of the tray secure, I glued 1/4-inch-square birch blocks to the fuselage sides to act as hold-down blocks. Dave Brown* fiberglass arrow

(Continued on page 89)

CONSTRUCTION

THE GENTLE GEE BEE

SORT-A-SCALE LONG-TAIL RACER

BY HENRY HAFFKE

HAVE YOU EVER wanted to fly a model Gee Bee but were afraid of the horrendous reputation they have? If so, be assured that you aren't alone. Well, to begin with, the bad reputation is completely unfounded, and that's being emphatically proved by Delmar Benjamin, who has been flying an exact replica of the ful-scale Gee Bee R-2. He not only flies it, but he also does unbelievable aerobatic maneuvers with it at air shows all over the country. Delmar explains that the problem with the Gee Bees was that when they were built in the early 1930s (the R-2 and its sister ship, the R-1, were built in 1932), no one had any experience with high-performance aircraft. In the 60 years between when they were built and when Delmar and Steve Wolf built the replica, aviation changed a lot and, in many cases, high-performance aircraft became the norm. Delmar has been a topnotch aerobatic performer for many years, and among the various aircraft he has owned is the well-known Pitts Special in which most of his time was built up. He likens the Gee Bee to a big Pitts.

Author Henry Haffke readies his SAS Gee Bee for another flight.

GENTLE GEE BEE

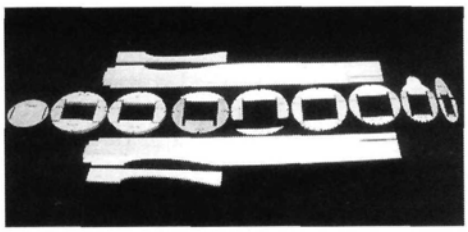
I've been designing exact-scale model aircraft for nearly 20 years, and all have been excellent fliers. Hundreds of Gee Bee models have been built from my plans, but I'm sure that there are still many skeptics out there who just don't believe that a Gee Bee can be a good flier. So I thought it was time that I designed a Gee Bee for those who would really like one but were afraid of a true-scale model. I call the model presented here a "Sort-A-Scale (SAS) Gee Bee."

The Sort-A-Scale Peashooter that I designed for the August 1987 issue of *Model Airplane News* was a low-wing sport model that was very simple to build and one of the best fliers I have ever flown. Actually, the only thing scale about it was the color scheme, which I stole from the Boeing P-26A Peashooter.

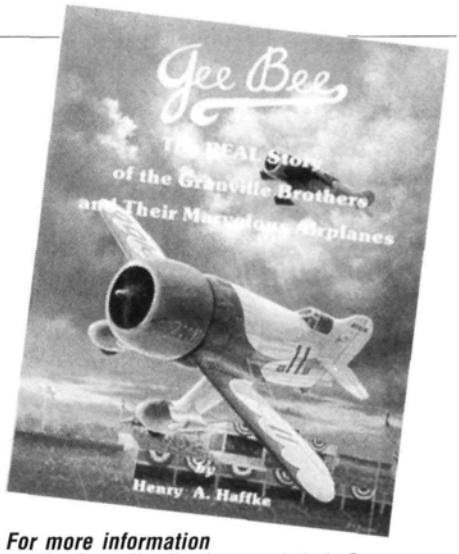
Last year, I wanted to build a sport model and decided to do a Peashooter, but to make it look more like a Gee Bee, I changed the shape of the wingtips and ailerons and the tail-surface shapes, keeping the same aerodynamic layout. I also changed the landing-gear position to use the familiar Gee Bee fully faired gear. I wanted a model that had a round fuselage and a radial cowl, so I reviewed the various Gee Bee designs I had already built and decided on one of my favorites—the little-known R-1/R-2 "Long-Tail Racer." To me, this has always been the most beautiful of all the Gee Bees. It had a very short life owing to a freak accident at a bad time, so it is practically unknown. The model I ended up with is the subject of this article.

ABOUT THE MODEL

I designed the model using a Precision Fiberglass Products* Waco F-3 cowl. Except for the bulk of the round fuselage, all dimensions of the Peashooter were retained. There are many options in the SAS Gee Bee. If you want to fly a Gee Bee-looking model but prefer not to do the work required for a round fuselage, you can build the original Peashooter fuselage and use the wing, landing gear and tail surfaces of the model presented here. The plans show built-up landing-gear fairings, but you can use the Precision Fiberglass Products Ryan ST wheel fairings by cutting away a little of the upper part of the fairings as shown on the plans. The shape of the Ryan ST wheel fairings is identical to that of the built-up ones I used.



Fuselage sides and formers are ready for assembly.



For more information on the Granville Brothers and their Gee Bees, check out the author's book "Gee Bee: The Real Story of the Granville Brothers and their Marvelous Airplanes."

FLIGHT PERFORMANCE

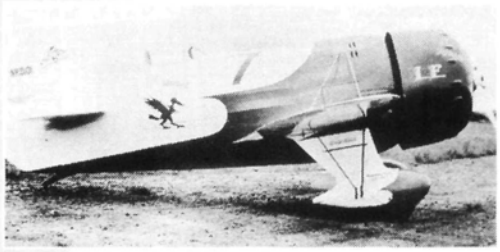
I opened the throttle, and the Gee Bee accelerated down the runway and lifted majestically into the sky. I had my hands full for a few laps around the field as I needed some elevator and aileron trim. When this was finally accomplished, the ship became very easy to fly, and I could relax a little. Although it's considerably heavier than the Peashooter, it's still a gentle flier.

The first flight consisted of some inverted flying, loops, rolls and a couple of Cuban-8s. The landing was beautiful and the test flight was very successful .

I made two more flights and found that it's a fun airplane to fly and a beautiful sight in the air. It's a great scale trainer and even looks the part.

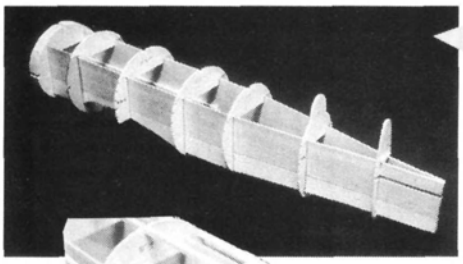
A Long-Tail Racer

The R-1/R-2 long-tail racer was built in the latter part of 1933 after both the R-1 and R-2 suffered accidents during and after the 1933 National Air Races. The R-1 was damaged when it flipped over on takeoff during the Bendix Race in Indianapolis, damaging the aircraft above the top longerons. The R-2 was rolled into a ball when Jimmy Haizlip attempted a short-field landing at Bowles Field in Agawam, MA, across the Connecticut River from Springfield, while practicing for the 1933 Chicago International Air Races. The R-2 was flying on a new wing with flaps that had been installed before the National Air Races. R-2's original wing was stored in the Gee Bee plant. The Granvilles and their chief engineer, Pete Miller, decided to repair the R-1 fuselage and mate it with the original R-2 wing (which was identical to the R-1 wing and had also been extensively damaged in the Indianapolis accident). While repairing the R-1 fuselage, "Granny" and Pete Miller decided to change the aft end of the racer by adding 18 inches and using a more conventional fin and rudder setup. This made the aircraft look much sleeker and gave it more speed. Pete Miller thought that it was the best of the "R" racers. While finishing the aircraft after the repairs, they decided to use the R-1 registration of NR2101 as that would alleviate the necessity of refinishing the wing; this would save valuable time. The racing number 7, which was on the wing, was also used on the newly painted fuselage. The Fillaloola bird (a comic-strip character in the '30s) was painted on its side for good luck; this had been a decoration on the very successful earlier Model Y Gee Bee. "I F" for Intestinal Fortitude was painted on the cowl, and the new, very attractive Gee Bee logo was painted on the fin.

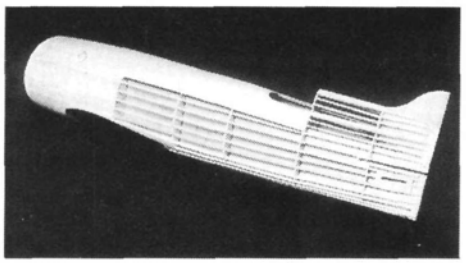


The long-tail racer Gee Bee R-1/R-2 was built out of the repaired remains of the R-1 and R-2 racers. It skidded off a wet runway and was severely damaged. It never raced.

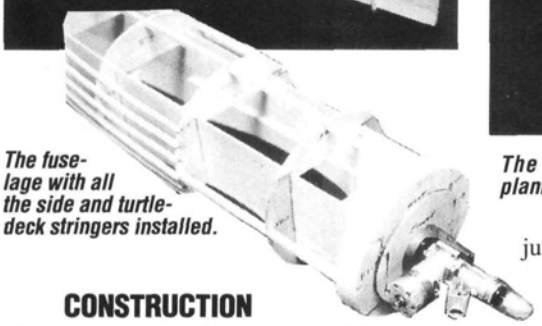
Roy Minor was engaged to test-fly the aircraft and also fly it in the upcoming Chicago races. His first flight was a thing of real beauty, but he had to make an early landing owing to a passing thunderstorm. He reported that the ship was fast, stable and easy to fly. After the storm had passed, he took it up again for further testing and, upon completion of the flight, he had to make several passes at the field. The tendency of the ship to float on landing caused him to abort and go around again each time. Finally, he put it down, but had used up too much of the field and, while braking, went off the end of the cinder strip into the wet grass where the brakes were useless. The beautiful aircraft skidded into a ditch at the end of the field and, as it tipped up on the prop, which was still ticking over, it flipped up over the fence and out of the airport. It came to rest on its gear in the road and suffered extensive damage to the wingtips and front end—a very undignified ending for such a beautiful and promising design. There was no more money to repair it, and it was the end of the Granville Brothers in air racing. A few months later, the company went bankrupt.



Here, the basic fuselage structure is complete with all the formers installed.



The completed fuselage structure has been planked and sanded and is ready to be covered.

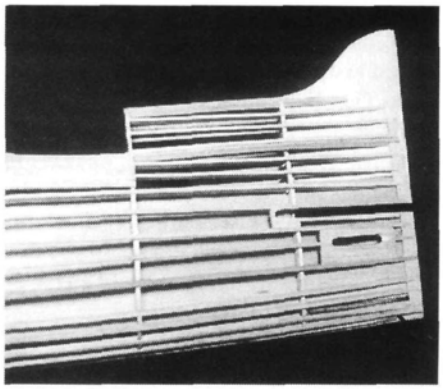


The fuselage with all the side and turtledeck stringers installed.

CONSTRUCTION

• **Fuselage.** Cut the 1/8-inch balsa sides to the outline shown on the plans. Do this carefully, paying attention to the cutouts for the tail surfaces and the protrusion at the front that engages the firewall. Cut the firewall out of 3/16-inch-thick ply and the F-2 bulkhead of 1/8-inch-thick ply. Cut F-1 (two sets are required) out of 1/2-inch-thick balsa. All other bulkheads are cut out of 1/8-inch-thick balsa. The marks show the position of the stringers, but I advise you to only cut the top and bottom center stringers until the fuselage has been basically assembled. The stringers will be straighter if the stringer cutouts are made just prior to adding each one—even if you were a little sloppy with the bulkhead assembly. Drill the holes in the firewall for the engine mount, the fuel lines and the throttle linkage. Install the engine mount to the firewall with T-nuts, and epoxy the T-nuts to the rear of the firewall. When the epoxy has cured, remove the mount until the basic assembly has been completed.

Mark the bulkhead locations on the fuselage sides, and start the assembly by epoxying the fuselage sides into the slots in the firewall. Do this with the firewall flat on your work area and, using a square, keep the sides perpendicular to the work surface. When the epoxy has cured, join the sides at the rear, keeping everything straight. Proceed by gluing the double layer F-1 parts in place against the firewall. Cut out the 1/4-inch-balsa saddle doublers, and glue them to the inside of the fuselage sides. Add the remaining fuselage bulkheads. Use epoxy on F-2 and your favorite adhesive on the rest of the work. Cut out the 1/8-inch ply tailskid mount, and glue it in place under the sides as shown. Make the 3/32-inch tailskid wire, and epoxy it into place on the mount. Add the top, bottom, front and side 1/4-inch-square stringers and the 1/8x1/4-inch bottom center stringer. Also add the top rear 1/8x1/4-inch stringer.



This close-up shows the rear stringer detail and the completed tail surfaces. See how the stringers are tapered and blend into the tail.

A TRIBUTE TO **THE GRANVILLE FAMILY**

An R-2 in a low inverted pass at 240mph. Note the neutral elevator position.

I've had many wonderful days of flying my model Gee Bees with one or more of the Granville family members. During the last years of his life, Bob Granville (the last of the famous five brothers from New Hampshire) and I became close friends. He attended several model meets with me and acted as my caller as I flew scale models of aircraft he and his brothers had designed and built. It was a great experience having him and his family members help me make the usual repairs, engine changes, etc., after a day's flying.

Other Granville family members, including Bob's sister Gladys and her husband Hiram (who did a lot of the welding on the full-size Gee Bees) and Zantford Granville's son Bobby, his sister Norma and Tom Granville's daughter June all attended model meets with me. They're all wonderful people and super friends. As the years went by, I got to know all the family members of the other brothers, Mark and Ed, and their other sister Pearl and her family.

FULL-SIZE GEE BEES

After 15 years of research, I wrote a book, "Gee Bee: The Real Story of the Granville Brothers and their Marvelous Airplanes" (ViP Publishing*). A big interest in Gee Bee aircraft has emerged in recent years, and many full-size replicas are under construction. So far, four have been completed and flown, and one of them has really had a positive impact on those who previously had only believed the bad things they read about Gee Bees.

When Delmar Benjamin and Steve Wolf visited me in November of 1990, we talked about building a replica of the R-2. They were really interested in hearing about the performance of my 1/4-scale R-1 model, particularly when I mentioned its knife-edge flight capabilities. They had felt that the aircraft would do this well. I gave them all the technical information I had gathered and the many photos I had of it, and put them in touch with Howell "Pete" Miller who had been the chief engineer on the full-size one. I also put them in touch with the crew who were building the R-1 replica in the New England Air Museum, which I had been involved with during the previous two years.

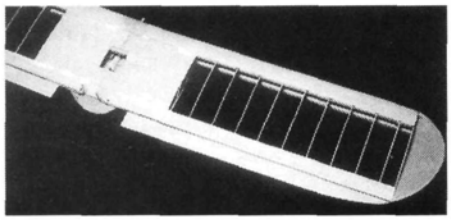
PHOTOS BY LEE GRANVILLE AND HENRY HAFFKE

Joan Vanderkop (Pearl), Norma Granville (Zantford), Debbie Trewheela (Mark), Bob Granville, (Bob) Charlotte Granville (Ed's widow) and Lee Granville (Bob) with Gladys Granville Jones in front.

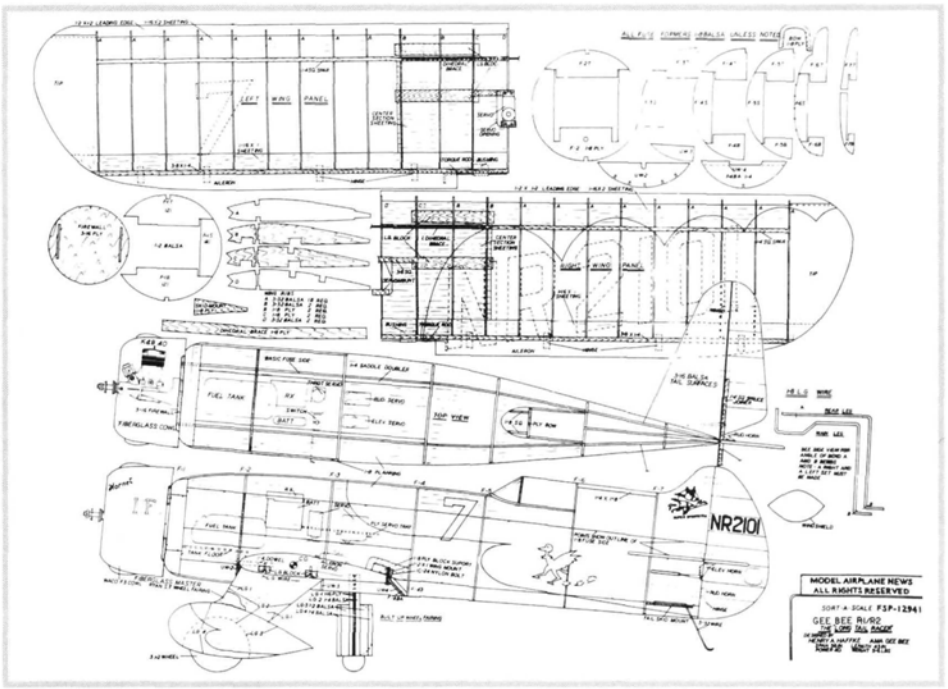
After the visit, they returned to Oregon and, six weeks later, started building the replica on January 1, 1991. It was test-flown on December 23 of that year.

The very first test flight included the execution of rolls and inverted and knife-edge flight—quite a bold undertaking with an airplane that had the reputation of being a "killer" that no one could handle. Delmar found out the problem: in 1932, no pilots had experience in high-performance aircraft; the Gee Bee was 60 years ahead of its time. Delmar says that, at speeds of more than 200mph, the Gee Bee will do anything he wants it to do. Delmar

Cut the tail surfaces out of 3/16-inch-thick balsa, and join the elevators with a length of 1/4-inch-square spruce that has been thinned to 3/16 inch. Test-fit the stab and the fin to the rear of the fuselage structure. For a snug fit, trim the lower rear part of the fin that fits between the joined fuselage sides. Glue the fin in place against F-7 with the bottom resting on the stab that hasn't been glued into place. When the fin joint has dried, remove the stab. Now add the side stringers, cutting slots for one stringer at a time by laying the stringer on the bulkheads and marking the location on each bulkhead where it must be slotted. Cut the slots and glue that stringer in place, tapering the inside of the stringer at the tail so that it flows smoothly into the side, ending at the tail. Now repeat this procedure for the same stringer on the opposite side of the fuselage. Add the remaining side stringers, alternating from one side to the other as each stringer is added. The turtle-deck stringers may be added in the same manner, fairing the rear ends into the fin (as shown in the photos).



The wing structure is simple and easy to build. Here, it's ready for final shaping and finishing.



Fill in the wing-saddle area between the fuselage sides and the lower stringers with two pieces of 1/2-inch balsa between F-2 and F-4. Make the wing-mount blocks and supports, and epoxy them into place against the saddle doubler. Glue the 1/4-inch F-4BA into place after trimming the top and bottom edges to fit as seen in the side view. Now the bottom stringers may be added. Before you complete the remaining structure, set up the radio; you'll have more room in which to work.

and Steve did computer calculations on the design and found that Pete Miller's 1932 predictions were right on.

After the 1993 Concord, NH, air show, Dick Bleakney, a good friend who is very interested in building a Gee Bee biplane replica, got a group of 25 interested individuals to donate money to pay Delmar Benjamin to fly his Gee Bee R-2 replica in the 1994 Concord International Air Show.

GEE BEE FLIGHT HONORS GRANVILLE FAMILY

After nearly a year of preparations, Delmar Benjamin flew his Gee Bee R-2 Super Sportster to Concord to perform for the crowd—and especially for the Granville family. The state of New Hampshire honored the Granville family, remembering the outstanding contributions that the Granville brothers, who all grew up on the Granville farm in Madison, NH, had made to advance aviation technology. Each of the five famous New Hampshire-born brothers, Zantford, Tom, Robert, Mark and Ed, as well as their two sisters Pearl and Gladys, were all represented by members of their families. Gladys, who still lives in Madison, was there with her husband, Hiram, and their two sons and their families. The widows of Ed and Mark were there as well as the children of Zantford, Tom, Bob and Pearl.

DELMAR PERFORMS

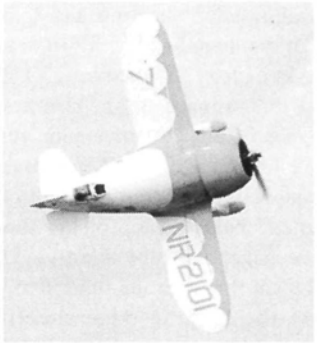
After the opening of the air show by the famous Golden Knights team, Delmar flew a short flight that included a roll on takeoff, inverted passes, a series of rolls and point rolls and knife-edge flight. After his landing, we pushed his beautiful Gee Bee replica up in front of the main grandstand and assembled members the Granville families in front of it. The state's Executive Councilor, Raymond S. Burton, talked about the Granville's contributions to aviation and presented a beautifully framed letter of commendation to a member of each of the seven families.

The commendation read in part, *"From the background of a farm family in Madison, NH, the Granville family came to influence not only military aircraft, but aviation design and truly the future of aviation as we know it today.*

The Granville family captivated the imagination of young and old alike. They created a legend that lives throughout the world today. Through technological creativity far in advance of the times and through individual effort, the Granville family made a lasting influence on aviation that will last forever."

It was an honor that was long overdue. Each family representative received a plaque and then said a few words about his or her brother, father, or husband as the case warranted.

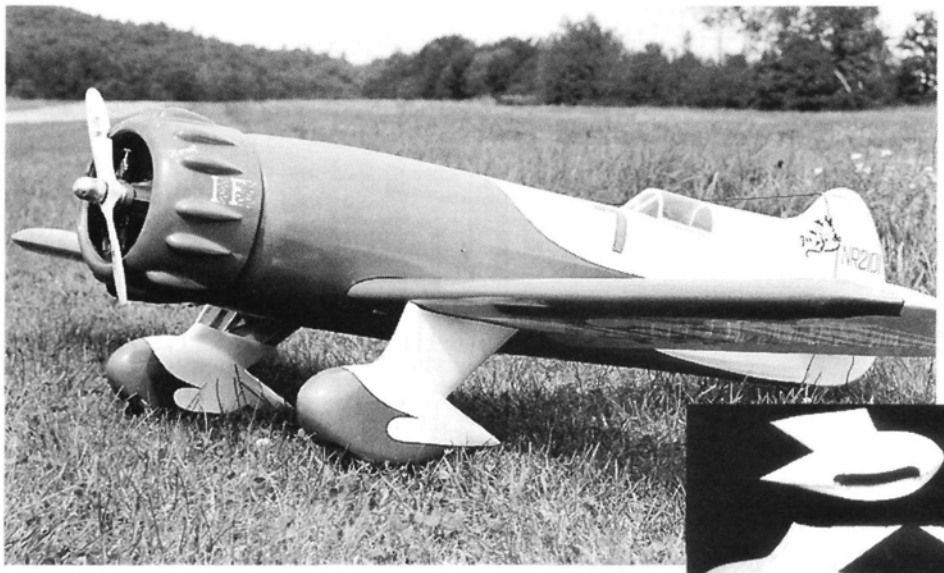
Later in the day, Delmar performed a second time, and he really went all out to excite the huge crowd. His last inverted pass got lower and lower until his rudder was very close to the ground. I would say that it was below 10 feet. He really enjoyed the opportunity to fly for the people who were responsible for designing and building the aircraft that he had chosen to replicate.



A knife-edge pass. Delmar says that he can run out a tank of fuel flying knife-edge. In this photo, he's just beginning to climb out in knife-edge.

Two years ago, he had flown to the East Coast specifically to fly the Gee Bee for Pete Miller and members of the Granville family that we got together at Bradley International airport in Connecticut near Pete Miller's home. He flew the Westover Air Show over that weekend, and some of the Granville family members were there to see him fly. Not all the families were represented at that time, and Delmar welcomed the New Hampshire weekend where members of all the families were represented.

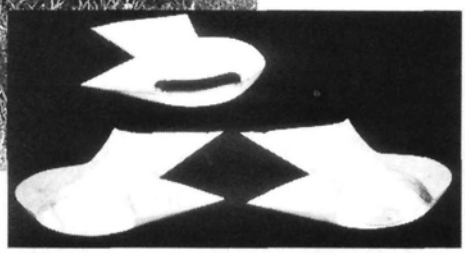
A special thanks for the affair must be given to Dick Bleakney and his friends whose generosity and efforts made this great weekend possible. It was certainly a weekend that the Granvilles and the rest of those in attendance will never forget.



When all the stringers have been added, the top and side planking can be started. I like to use 1/8x1/4 strips; I think this does a better job than sheet material and, to me, it's easier to work this way. When the planking has dried completely, it can be sanded to final shape, and the stringers can also be sanded for a smooth, even surface. The stab can be glued into place, and the tail surfaces can be hinged. You might want to cover the stab before you glue it into place.

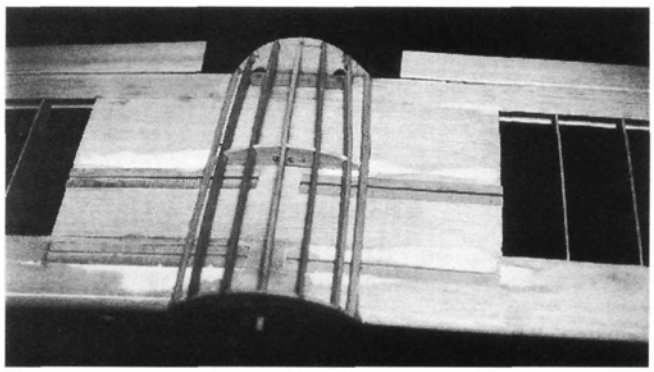
• **Wing.** The wing is very easy to build and will go together quickly. Cut all the wing ribs out of the material shown on the plans. Start construction by making the leading- and trailing-edge sheeting and spar assemblies. Cut two lengths of 1/16x2-inch balsa sheets to 25 3/8 inches, and cut two 25 3/8-inch pieces of 1/4-inch-square balsa. Use a sheet of wax paper or plastic film under your work, and lay one of the 1/16x2-inch balsa pieces on your worktable. Put a length of the 1/4-inch-square balsa on top of the sheet flush with one edge, and glue them together with CA. Repeat this with the other two pieces. These are the leading-edge sheeting and spar assemblies.

Cut two 27-inch-long pieces of 1/16x1-inch balsa and two 27-inch-long pieces of 1/4x3/8-inch balsa. Lay a sheet of the 1/16x1-inch balsa on your worktable. Butt one of the 1/4x3/8-inch pieces against one edge of this sheet (with the 1/4-inch side against the worktable), and glue them together with CA. Make a second such assembly. These are the trailing-edge sheeting and trailing-edge assemblies. Lay a leading-edge assembly and a trailing-edge assembly over your plan. Connect them with an "A" rib at the tip and another at the innermost "A" rib location. Glue these in position, making sure that they're properly seated with the rear sheeting tight against the cutout in the bottom of the rib. Glue the front of the rib to only the spar; don't glue it to the sheeting. Install the remaining "A" ribs in the same manner, making sure they're each seated correctly. Glue the rear part of the B, C and D ribs in place. The "D" rib should be glued at a slight angle to allow for the dihedral of the wing. Glue the top 1/4-inch-square spars into place in the notches in the tops of the ribs. Install the 1/2-inch-square leading edge in the notches in the front of each rib. Fit the front part of the B, C and D ribs into place with the D rib at the same angle as the rear of the rib previously installed. Now you can glue the leading-edge sheeting to the bottom of the ribs and leading edge. This can be done with CA while holding the sheeting tightly in place against the rib and leading edge. Build the opposite wing panel in the same way.



Here, the wooden wheel fairings have been shaped. Built in halves, they can be tack-glued together over the landing gear and wheels for easy removal if repairs are necessary.

Add the 2x1/16-inch sheeting to the tops of the panel leading edge and the 1x1/16-inch sheeting at the trailing edge. Slide the dihedral brace into the slot of the inboard ribs of one wing panel, and slide the other wing panel on the other end of the dihedral brace. Trim the center ribs for a good, tight fit. When you're satisfied with the center fit, epoxy the dihedral brace into place, making sure that the panels are lined up correctly. To keep the panels aligned while the glue dries, block the tips up to the same height. Install the landing-gear blocks in the bottom of the wing and install the 1/4-inch dowel in the leading edge. Drill a 1/4-inch hole through the leading edge and the two center ribs only as deep as the dihedral brace; don't drill into the brace. Epoxy the dowel into place. Add the 3/8-inch-square servo-mount blocks, and then add the center-section sheeting on the top and bottom of the wing. Make the wingtips out of two layers of 1/8-inch-thick balsa. Bevel the leading edge of each of the four tip pieces so that when each set is glued together, there will be a V-notch to fit against the rear of the leading edge (see the broken line on the plans). Glue the tips into place, and then trim the excess material from trailing edge. This completes the wing structure, and it can be sanded to final shape. For a docile flier, round the front of the leading edge to a blunt radius. A model with a sharper radius will react more quickly and should be flown only by more experienced pilots.

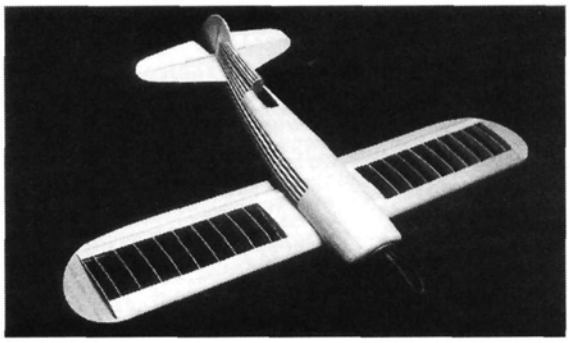


The fuselage fairing under the wing consists of three formers and a few stringers.

Fit the wing to the saddle, and sand where necessary for a good fit. Line the wing up by measuring from each tip to the tail post. Make sure this measurement is the same on each side. When proper alignment has been achieved, drill though the wing trailing edge and wing-mount blocks on both sides with a no. 25 bit. Enlarge the holes through the

wing after installing a ½x4-inch strip of 1/16-inch ply centered over the holes. Use a no. 7 bit to enlarge the holes. Tap the wing-mount blocks for a 10-24 bolt, and secure the wing with 1-inch-long nylon bolts. With the wing attached to the fuselage, install the bulkheads UW-2, UW-3 and UW-4 on the underside of the wing. Add the stringers, and sand carefully so that everything blends smoothly into the fuselage shape. Make up the ailerons and hinge them to the trailing edge. Install the aileron servo, and hook up the aileron linkage. Relieve the structure as necessary to get full aileron crank movement.

• **Landing gear.** Bend the landing-gear wires as shown on the plans, making sure you make a set for the right and left sides. Mount the wires in the blocks with gear straps, and bind and solder the front and rear wires together, creating the angle shown on the plans. Landing-gear fairings can be built up out of the wood parts shown on the plans. Laminate the various parts as shown. Each gear fairing must be a right and left half to be sandwiched over the gear wires when finished. Don't glue the ply parts together. Fairing halves can be pegged together with 1/16-inch dowel, gluing the dowel in one part so that it will fit into the holes in the other. Each fairing can be carved and sanded to shape with the two parts pegged together. When they're complete, the halves can be spot-glued together for final installation. This will allow parts to pop apart in the event of a rough landing.



The assembled aircraft is ready for covering.

COVERING AND FINISHING

My model was covered with Coverite's* new 21st Century fabric. This pre-painted material is very easy to apply. I've always preferred fabric coverings; they're far more durable than film coverings, and I prefer the more realistic fabric look over the shiny look of film. Before I applied the covering, I gave the entire model a coat of Balsarite*. I covered the entire model with white fabric and then cut out the red trim fabric. I made a paper pattern for the wing scallop trim and cut four identical (two right and two left) pieces; I carefully positioned these and ironed them over the white covering. I did the same for the side of the fuselage, making a right and left side from a pattern. If you haven't tried this technique before, you'll be surprised by the results.

A 1/16-inch black pinstripe separates the red and white. I used Coverite's pinstriping, which comes on a flat sheet rather than in a rolled tape. I find this easier to work with, and the vinyl tape bends more easily than any others I have used. All remaining trim was done with Coverite's Graphics trim-sheet material. Patterns for the fin emblem and the Fillaloola bird are shown on the plan.

The cowl and wheel fairings were painted with the new 21st Century paint. The cowl was done in red and the wheel fairings in white. The red trim on the wheel fairings was cut out of red trim-sheet material and applied to the fairings. This is possible because of the vinyl material which can be stretched over compound curves. Black pinstripe separates the colors on the fairings. Cut the windshield and cockpit cover out of clear material and glue in place to complete the model. Reinstall the engine, radio and control surfaces, and prepare the model for flight.

FIRST FLIGHT

Not having my good friend Sid Clement (South Jersey's "Test Pilot Supreme") available, I was forced to do my own test flying. Sid had always tested all my new designs when we both lived in New Jersey; he can fly around the patch a couple of times and tell you exactly what adjustments should be made. Also, I'm always more steady flying a new model after I've seen it in the air.

As fate would have it, the only model I can remember testing myself was my scale version of this same aircraft, and that was 15 years ago. So, as you can imagine, my fingers weren't really steady as the model posed on the runway idling for its first flight. There was nothing to worry about, however; after all, it was really a Peashooter in disguise.

Now anyone can become a Gee Bee pilot with this Sort-A-Scale Long-Tail Racer. I hope that you'll enjoy flying yours as much as I enjoy mine.

**Addresses are listed alphabetically in the Index of Manufacturers on page 153.* ■

Each day, flying was suspended for an hour so that the crowd could view the models and talk with the modelers. Almost 100 models were entered.

Bill Steffes and his Beech D-18 twin. Zirloi design.

THE SEVENTH Annual Giant Warbirds Festival was held on July 22 to 24 at the Schenectady Aerospace & Science Museum, which is adjacent to the Schenectady County Airport. Pilots began to arrive on Thursday in preparation for the weekend event, and they came from as far away as Florida, Michigan and Canada. Some of the biggest names in modeling also showed up.

7th Annual Giant Warbirds Festival

WW II history in miniature

by JOHN JULIAN

REPORTING FOR DUTY

Pilots registered on Friday at the "military induction center," where paperwork and other vital statistics were scrutinized. Aircraft safety inspections and radio impound were dealt with quickly and efficiently by a small army of helpful volunteers. Each morning, after the mandatory pilots' meeting, the national anthem was played

Mac Smith of Johnstown, NY, built this wonderful Messerschmitt Bf 110 Zerstörer. Not quite ready to fly, the all-wood model has a wingspan of 134 inches and will be powered by a pair of SuperTigre 4500 glow engines.

Nick Ziroli Jr. (right) and Lenny Stanko pose with their Curtiss P-40 Warhawk. These powerful fighters flew up a storm during the meet. Nick Jr. offers fiberglass fuselages, cowls, fairings and formed canopies and side windows for fighters. A wing and tail kit is available from The Aeroplane Works.

over the PA system and, on Sunday, in honor of our northern flying allies, the Canadian anthem was also broadcast. With the picture-perfect weather and an anxious bunch of heavy-iron warbird pilots ready to demonstrate their in-the-air prowess, the Warbirds Festival was off to a great start.

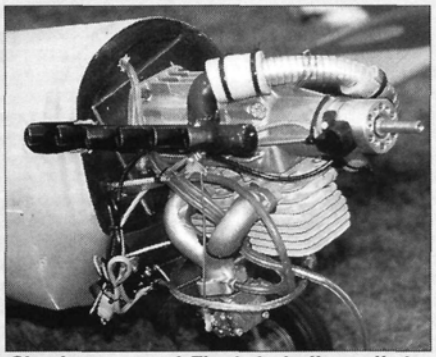
IN THE MOOD

The days of WW II seemed to come alive once more at the Warbirds Festival and, to get everyone in the mood, music by the Andrew Sisters, Glenn Miller and Spike Jones filled the air. It was amazing to walk through the crowd and listen to the many WW II veterans talk about their experiences; it really added flavor to the event. With the hard work of all involved with the Festival, the heritage of WW II aviation was brought into focus for a brief moment so we could reflect on the sacrifices that our men and women endured during this period of history. The weekend also gave the public a grand opportunity to see in miniature the beauty of the powerful war machines that filled the skies around the world from 1935 to 1950.

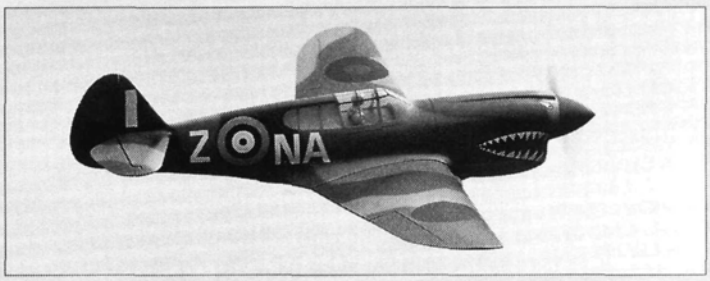
The warbirds came in various forms—from flitting grasshopper (L-birds) to heavy, multi-engine bombers and everything in between. More than 70 pilots and well over 100 models were entered in the event, and the action was almost nonstop. The skies over Schenectady were filled with flybys, mock dogfights and formation flying. On Sunday, a "Missing Man" formation took place to honor Mark Tyoe, who passed away last year. Roy Vaillancourt, Mike Gross, Nick Ziroli Jr. and Ron Chizek (who did the pull-up maneuver) flew this emotional salute to their friend. As I turned to look at Mark Tyoe's wife, Janet, who was standing just behind the pilots with close friends, I noticed that there wasn't a dry eye in the

Ziroli Squadron Warhawks

The skies over Schenectady during the Warbird Festival are never quiet. The sound of gasoline engines rules the clouds. After a while, you can almost recognize an engine by its tone and cadence. One particular warbird—Nick Ziroli Jr.'s 2½-inch-to-the-foot-scale Curtiss P-40 Warhawk—sang a different baritone. Under the cowl of the Ziroli-designed fighter was a German-made 3W, twin, in-line cylinder, 80cc powerplant that's distributed by Desert Aircraft. Putting out an awesome 7.5hp, the engine turns a 24x14 prop and is married to Nick Jr's. homemade exhaust system that has all the go-gases exiting from 12 exhaust stacks. The sound of this system connected to the 4.9ci engine is music to any warbird lover's ears. Nick's wing man and the man who makes Ziroli's beautiful fiberglass fuselages is Lenny Stanko. Lenny's P-40 is identical to Nick's, except for the engine, which is a Sachs 4.2ci turning a 24x14 prop. With the Robart* retracts tucked away and the props harvesting air, these two fighters showed everyone what a Warhawk was all about. If you think that most giant models of the old shark-toothed fighter are underpowered, watch out!



Simply awesome! The twin in-line cylinder 3W engine in Nick Jr's. P-40 has an 80cc displacement and produces 7.5hp.



Nick Ziroli Jr. makes another strafing mission with his powerful Curtiss P-40 Warhawk. The 3W engine powered the fighter with horses to spare.

SPECIFICS

If you want power, Nick's new fighter and the 3W are hard to beat. The P-40 has a fiberglass fuselage and cowl, a belly pan and landing-gear fairings as well as a formed canopy and side windows (all available, including plans from Nick Ziroli Models*). The wingspan is 94 inches, the length is 77 inches, the wing area is 1,525 square inches and, with the 3W engine, it weighs less than 40 pounds. The wing and empennage are available as a kit from The Aeroplane Works. Each kit includes all the ribs, sheeting, plywood, spars and assorted pieces needed to build the wing as well as the fuselage formers and the firewall to complete the fuselage construction. These new models are just the thing for the Flying Tiger in us all.

—Gerry Yarrish

Rich Uravitch's Midwest AT-6 Texan was done up in Guantanamo Bay colors. The all-wood model is powered by a Webra 1.20 2-stroke glow engine and sports Robart retracts.*

Roy Vaillancourt's L-5 lands in a slight crosswind. Roy kept this Quadra 40-powered workhorse in the air most of the weekend.

Tony Kirchenko's Grumman Hellcat flew rock-solid. Many times over the weekend, Tony and Nick Ziroli Jr. played "How low can you go?"

The Moose is Loose

At most warbird gatherings, you'll find Mustangs, Thunderbolts and Texans. Sometimes you run into an unusual aircraft—one that few would recognize. A modeler who wants his aircraft to stand out from the rest is Barry Herthum of Connecticut. His WW II heavy-metal model is a Soviet Yak 11 "Moose"!

The Yak 11 Moose—a plane that has many parts. Barry Herthum (left) and Chuck Gill of the Aeroplane Works show off the Soviet fighter.

MODELING A MOOSE

When Barry was in Delaware attending the first Warbirds Festival, he discussed his project with Chuck Gill of The Aeroplane Works*. As a result of their brainstorming, the final version of the Yak uses a modified AT-6 Texan fuselage and a P-40 horizontal and vertical tail all from The Aeroplane Works. A Don Smith Plans* cowl and a modified Desert Aircraft* canopy were also used. Sorry, no plans are yet available.

SPECIFICATIONS

It took Barry eight months to build the Yak. Powered by a Zenoah* G-62, the finished model weighs 31 pounds, and it has split flaps, Spring Air* retracts and a wingspan of 96 inches. The fiberglass-cloth and epoxy-resin finish is painted with military spec paints.

Barry says that the model flies extremely well and has power to spare. With the help of his crew chief, Joyce Herthum, Barry expects to campaign the Moose at many Warbird meets. Look out for that Moose! —*Gerry Yarrish*

bunch. Needless to say, everyone was caught up in the moment.

AT EASE

Unlike scale competitions, the Warbird Festival focuses on fun and flying. Each morning, the first order of business was to get a cup of coffee and discuss the previous day's war stories. Pilots arrived at about 9 a.m., got their warbirds ready and did what they came to do—fly! At noon on both days, all models were rolled out onto the center line of the runway, and the crowd was invited for a closer look at the planes and to ask questions of the pilots.

Dennis Richardson's R4D "Susie Q," powered by Quadra 42s, comes in for another successful landing.

Vern O'Brien of Amsterdam, NY, built this super Ziroli AT-6 Texan. Power comes from a Zenoah G-62.

The fine food, the drink concession, the PX, manufacturers' row, the raffles and the lively commentary from the tower (complete with sound effects) made a wonderful weekend for modelers and history buffs alike.

FLYING FIRSTS

At the end of the day on Saturday when everyone was running out of gas (and fuel for their models!), a few models were test-flown. The thinking was that if they were successful, it would open up all of Sunday for them to fly. The first was the spectacular 1/3-scale Stinson L-5 Sentinel built from Vailly Aviation* plans by Myron Eister. The model was flown by Ken Hall and Roy Vaillancourt, who designed the model.

The L-5 flew with all the realism of the actual aircraft and even did some aerobatics to keep things interesting. With its huge 136-inch wingspan, flaps, slotted leading

Not exactly WW II vintage, this C-130 from the local Air National Guard made a number of photo passes. Goosebump city!

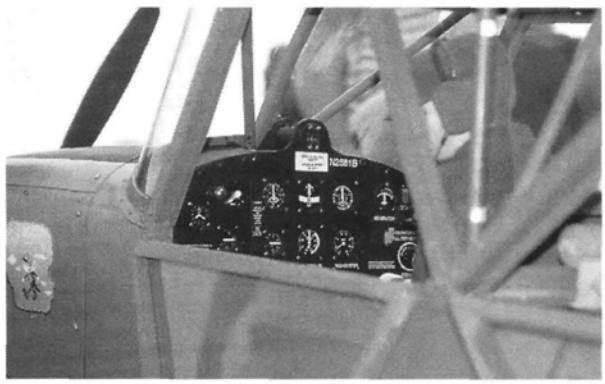
Full-size flight

This year's Warbird's Festival was a mix of model and full-size aviation. As in the past, this year, a full-size P-51 Mustang performed numerous high-speed flybys. It landed at the Schenectady Airport, taxied to the Empire State Aeroscience Museum and parked so the crowd could get an up-close look at a real WW II fighter. But that wasn't all! The local Air National Guard also got into the act and allowed one of its gigantic C-130 Hercules cargo planes to come in low for a few flybys. The four-engine C-130 came in at about 250 feet for a beautiful pass. Later, the pilot of the C-130 drove to the Warbird fest and spoke with some of the model pilots. Wait, there's still more!

On the last day, a beautiful Messerschmitt Me108 (unannounced and a complete surprise to all) landed and taxied to the museum parking lot. One of only three in the world that actually fly, the WW II German training aircraft had been completely restored and painted in authentic German markings.

edge and Horner 70cc gasoline engine, it was impressive. The interior was completely detailed with everything imaginable—lights, radios (with working dial lights), a functional fire extinguisher, maps, checklists and an operations manual. In the aft compartment, a mortally wounded GI was strapped in a gurney (even his serious belly wound was accurately detailed). Myron was all smiles and has every right to be proud of his crowd-pleasing model.

The second model in the test-flight lineup was the beautiful, though short-lived, SNJ-6 Texan built by *Model Airplane News* associate editor Gerry Yarrish. Built from a Bridi* kit, this Madera T-6 racing model was an all-silver dream machine complete with fully detailed pilot and interior. There was a parachute in the rear cockpit, a tricked-out dummy radial engine in the nose and the model was painted in Jacksonville, FL, instrument training squadron markings. The retracts, split flaps and Zenoah* G-62 were all checked, and the model was cleared for flight. Unfortunately, the total flight lasted 3 minutes! Gerry was turning from base to final at about 100 feet and, as the Texan slowed down, it snapped to the left. As it rolled over, he over-corrected, and it snapped in the opposite direction. The Texan hit dead center on the yellow line of the museum's taxiway!



Above and right: Myron Eister (left) and designer Roy Vaillancourt show off Myron's beautiful 1/3-scale Stinson L-5 Sentinel. This particular model was outfitted as an air-ambulance complete with mortally wounded soldier in the aft part of the fuselage. Wingspan: 136 inches; SuperShrink Coverite finish; and a Horner 70cc gasoline engine for power.

Gerry took this setback like a trooper, and he'll be building another one next year. There were no more test flights that weekend.

The professionalism and dedication of our host, the Thundervolts R/C Club, and our sponsor, the Miniature Warbirds Ltd. and staff, and the pilots, the pit crews and flight-line safety officer Sal Saverses made this year's warbird meet the safest and best yet. This event is gaining in popularity, and next year, it will be even bigger and better.

Special thanks to our other sponsors: Builder's Square, Adirondack Giant Sport Flyers, Empire State Airshow Team and Lazy Eight's R/C Club. ■

Model Airplane News associate editor Gerry Yarrish's G-62-powered SNJ-6 taxies out for its first (and last) flight. Built from a Bridi kit, the racer-turned-warbird had a fully symmetrical airfoil, a fiberglass fuse and a full cockpit and engine details.

Veteran of many Warbird meets, Mike Gross readies his Vailly Aviation P-47 Thunderbolt for another sortie. G-62-powered, the fighter has a 92-inch wingspan, flaps and retracts.

CHECK-OUT RIDE

One of the highlights of the weekend was an hour-long check-out ride in a Cessna 172 Skylark—a raffle prize won by Lisa Ames of Bridgewater, NJ. The ride included a tour of the Schenectady area and a hop over to Lake George, NY. With picture-perfect, VFR weather and unlimited visibility, Lisa's first trip in a small plane was a wonderful experience. She's the fiancée of Mace Gill, son of Chuck Gill of The Aeroplane Works. What a grand ending to a grand weekend.

Lisa talks to Dan as they fly over Lake George, NY. What a great raffle prize!

The lucky winner of the Cessna 172 check-out ride was Lisa Ames, shown here with pilot Dan Whiteman.

STREAM INC.

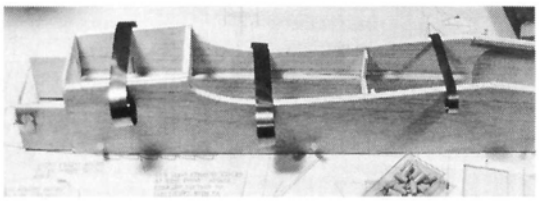
schneider sport 60-E

by BERNARD CAWLEY, JR.

ABOUT TWO YEARS ago, Stream Inc.* decided to enter the electric-airplane market with a fully aerobatic design based on its Schneider Sport 60. Tom Strom, head man at Stream, got together with noted Pacific Northwest electric modeler Bob Benjamin to develop a prototype of the low-wing sportster. Compared with the Sport 60, the electric prototype used a slightly longer wing and had a much lighter structure. A semisymmetrical airfoil was used rather than the fully symmetrical airfoil of the glow-powered Sport 60. Bob powered the prototype with an Astro Flight* geared Cobalt 25 on 16 cells. This good-looking airplane was introduced to the public at the 1993 Northwest Model Expo, and it impressed those who saw it fly from land or water last season. I was one of those admiring observers, but I thought that it would probably be beyond my limited piloting skills.

PHOTO BY BERNARD CAWLEY, JR.

The Sport 60-E is a fully aerobatic, electric version of Stream Inc.'s popular Schneider 60 glow kit.



The basic fuselage box is aligned and assembled over the fuselage plan view.

The Schneider Sport 60-E kit followed the structure of the Benjamin prototype, but it returned to the aerodynamics of the original Schneider Sport 60, including its 18-percent-thick symmetrical wing. Last fall, after a bit of arm-twisting, I agreed to take on the task of building one from the first run of kits and to write this review. When I flew my 60-E flew at the Celebration of Silent Flight, I learned that my misgivings were unfounded. I discovered a new level of performance in electric sport planes—one that doesn't need spray cleaner and towels after a satisfying flight.

THE KIT

Carefully packed in a large box are machine-cut balsa and ply parts that are bundled according to function. Small parts come in three plastic bags marked with color-coded labels. There are also two bags containing all the hardware bits for the controls and landing gear (except for the hinges and the pushrods); a beautifully formed ABS cowl and dummy exhaust stacks; and a very strong, preformed, aluminum, main landing gear.

The CAD-drawn plans are some of the finest I've ever seen, and they come in two, rolled, blueline sheets. One sheet shows both wing panels, the tail surfaces and the fuselage crutch. The other shows two complete views of the fuselage. Both sheets have numerous details and cross-sections to clarify the con-

Early wing construction. Note the jig tabs on the ribs that allow the symmetrical wing to be built flat on the board.

FLIGHT PERFORMANCE

• Takeoff and landing

With just a touch of rudder to keep the ship centered, takeoffs are almost automatic. A little back pressure on the stick establishes a firm, fast climb. If you wait a bit longer, the 60-E will come up by itself.

Landings can be made either on the main gear for a smooth rollout, or more slowly in three-point, full-stall fashion. Because the main gear is rather stiff, it takes more finesse to make smooth three-pointers, but they sure are pretty. Fast or slow, there's no hint of tip-stalls, and the controls have plenty of authority right down to stall speed—even on a nose-high "drag 'em in" approach.

• High-speed handling

No matter how hard the plane was pushed, full-deflection turns come around smartly with no hint of a tip-stall. Unless the balance point is too far forward (as it was on the first 16-cell flight), there's no urge to re-trim from full power to minimum level-flight speed.

• Low-speed handling

Looking at the symmetrical wing, I was expecting that the plane wouldn't slow down. Wrong! The Schneider Sport can be slowed way down. When the stall finally does come, it's soft, straight ahead and with little altitude needed for recovery. This is true whether the motor is running or not. Even at minimum air speed, all three control axes have adequate authority.

• Aerobatics

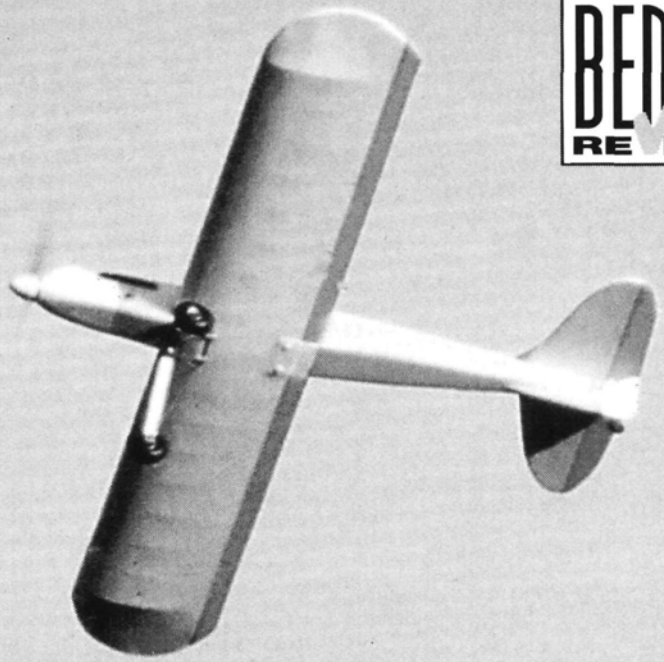
The Schneider Sport may look like a scale ship, but under that pretty exterior beats the heart of a pattern plane. And that's how it performs: it goes where you point it smoothly and confidently. The recommended control throws give smooth rolls at a rate of about 2 seconds per roll. With these throws and a forward CG, snap maneuvers are difficult because there is no sharp stall.

After his first flight, Jerry Holcomb remarked that he'd like a faster roll rate, but it will be a while before I need the increased response. Other experienced aerobatic pilots who have flown the 60-E have unanimously pronounced it "smooth." One likened it to a Kaos in handling and capabilities.

Inverted flight is a joy; little forward pressure is needed to keep the nose up. Even on 14 cells, consecutive, round, outside loops come easily.

The bottom line is that this is a capable, but sweet-flying, plane that needs no excuses made for it at the local "wet power" flying field. Enjoy!

FIELD & BENCH REVIEW



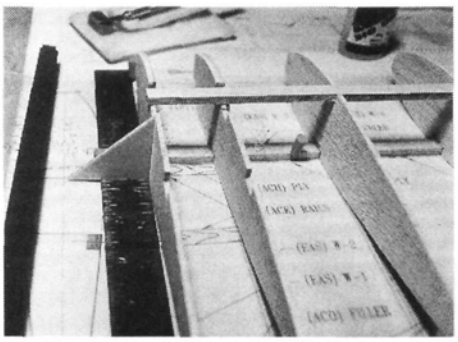
A fast and nimble electric sportster

SPECIFICATIONS

Model name: Schneider Sport 60-E
Type: electric aerobatic sport
Manufacturer: Stream Inc.
List price: $129.95 (wheels only version); $229.95 deluxe (wheels and floats)
Wingspan: 63 in.
Wing area: 667 sq. in.
Weight: 6 to 7 lb. on wheels; 6 lb., 3 oz. with 14 cells on wheels, as tested; 7½ to 8 ½ lb. on floats; 8 lb., 1 oz. with 16 cells, as tested.
Wing loading: 21.2 to 24.4 oz. per sq. ft.; 21.4 oz. per sq. ft. with 14 cells as tested; 25.9 to 29.4 oz. per sq. ft. with floats; 27.9 oz. per sq. ft. with 16 cells as tested.
Length: 47 in. (wheels); 50½ in. (floats)
Motor used: Astro Flight geared Cobalt 25 on 14 and 16 cells
No. channels req'd: 4 (throttle, rudder, elevator, aileron)
Motor recommended: geared Cobalt 25 or 40-size
Radio used: Airtronics* Championship 7
Prop used: Master Airscrew* wood 13x8 electric
Airfoil: 18-percent-thick, fully symmetrical
Washout in wing: none
Wing construction: wood, built-up, single spar, D-tube
Kit construction: all wood (balsa and ply wood) with ABS cowl and aluminum main gear
Floats: ABS with aluminum support struts
Features: good-quality wood and hardware and generally well-fitting parts built into a sturdy, yet light, good-looking airplane. The ABS cowl completes the front end neatly. As designed, Stream floats and wheel gear are a simple bolt-on swap.

Hits
- Sparkling aerobatic performance with no bad habits at any flight speed.
- Easy access to power and radio equipment.
- Attractive 1930s racing-plane appearance.
- Well-executed, well-engineered construction with great plans.
- Strong support from the manufacturer.

Misses
- A couple of minor problems fitting parts.



Setting the root rib angle with the template provided.

struction. Also included are a two-page parts list and 10 pages of step-by-step instructions.

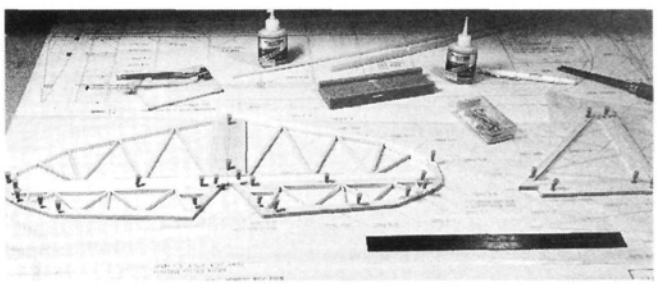
The kit contained a few parts made of heavier wood than I would have chosen for the same task, but I didn't replace any of them. There was one lite-ply part that I thought should have been stouter (the motor-mount bulkhead), so I remade it of ⅛-inch-thick birch ply. When I mentioned this to Tom Strom, he said that he had intended the bulkhead to be an easily replaced part that would absorb energy in a crash and protect the front of the fuselage.

I found the kit's weight to be a good predictor of the finished airframe's weight. The total kit contents weighed 41 ounces. This was a good sign for a 667-square-inch aerobatic ship.

CONSTRUCTION

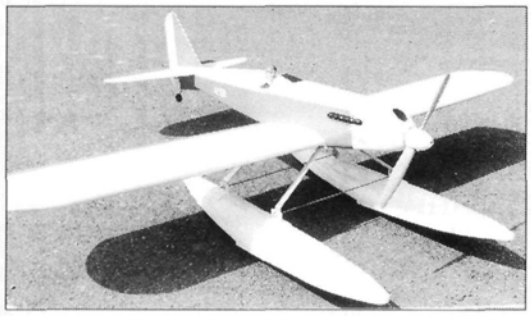
Beginning with the basic fuselage, I built the Sport 60-E according to the instructions and in the sequence outlined. Along the way, I found a few glitches in the instructions and an occasional mismatch between them and the plans—nothing major and certainly understandable for a kit from the first-production run. I've been assured that these problems have been corrected in subsequent runs.

Construction of the fully symmetrical wing (my first) was eased by the jig tabs on the ribs. The wingspan (without the wingtips) is 52 inches, and the two wing panels are joined rather early in the assembly process, which caused me some trouble because of my fairly small building area. Make sure that you have adequate space in which to work when you install the bottom leading-edge sheeting and the bottom capstrips and when you check the wing alignment with the partially completed fuselage. The tail feathers are flat, ¼-inch-thick, built-up structures—no surprises here.



Tail feathers under construction.

GOING AQUATIC

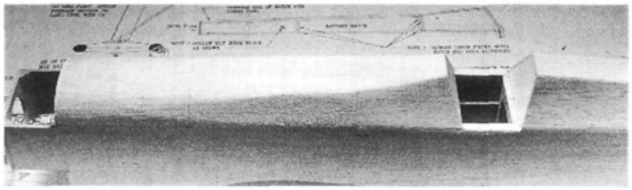


The Schneider Sport family—including the 60-E—can easily be converted to float-plane configuration by adding the Stream float set (included with the Deluxe 60-E kit). Installation of the floats is a simple matter of drilling and tapping another hole for an additional nylon bolt between the two wing bolts. The rear float strut is mounted with the same bolts as those used to mount the wing to the fuselage. The front strut replaces the main gear. I enlarged some of the holes just a bit to fit the struts to my plane. The floats add about 1½ pounds to the flying weight, and that brings the wing loading to just under 28 ounces per square foot. When floats are used, the motor's battery pack will have to be shifted forward about 1 inch to bring the CG back to the correct location.

Considering that there is no water rudder and that I had to get used to taxiing with full rudder and short bursts of power, the plane handled surprisingly well my first time on the water. After lining up into the breeze and advancing the throttle, the Schneider Sport was almost instantly on the step and accelerating rapidly. A nudge of up-elevator, and it was off the smooth water and climbing strongly, almost as if the extra weight and drag caused by the floats didn't matter.

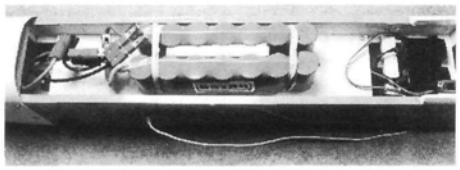
The added weight made it necessary to increase power throughout the flight, and it moderately reduced aerobatic capability. One thing that didn't change was the forgiving nature of the wing, even in very steeply banked turns. Marvelous!

When it was time to land, I leveled off, chopped the power and let the plane glide. I pulled back to flare as it neared touchdown, which was smooth and well under control, despite my nerves. The Schneider settled back easily on the lake, showing no tendency to dig a float or tip over, and the taxi back to the dock was as pretty as you please. I know I'm going to have fun exploring the aquatic dimension of the Schneider Sport's smooth personality.



Completed hood and turtle deck.

After the flying surfaces have been completed and the wing has been fitted to the saddle, finish the control installations and build the turtle deck and the hood. I used a set of the new Sullivan* Precision pushrods for the elevator and rudder. I have a minor complaint about the hood. For some reason, the front third of the hood is made out of a solid block of balsa, most of which winds up on the shop floor when you've finished. I don't know why it couldn't have been made out of balsa sheet like the rest of the hood; that would save a lot of carving. Perhaps the transition from flat sides to elliptical is best done with block balsa. When complete, the hood fits under the plastic cowl in the front and is held down in the rear by two Goldberg* angle-hatch latches. This provides convenient access to the motor battery for charging or removal.



The top of the equipment tray shows the motor battery and power wiring. The tail-surface servos on rails are in the cockpit area.

I made one small change during final assembly. Because my club has an asphalt runway, I fitted a 1-inch-diameter tail wheel in place of the steerable skid shown in the plans.

One convenient feature of the design is the method used to mount the power and control equipment. A plywood tray, mounted on hardwood rails (with four screws), runs from Former 1 nearly to the wing's trailing edge. There's plenty of room for standard-size radio equipment. The motor battery is attached with Velcro®-brand fastener to the top of this tray. The receiver and its battery and the speed controller are attached to the underside of the tray (sticky-back Velcro® works fine here, too).

COVERING, FINISH, AND EQUIPMENT

I covered my Schneider Sport with white and Fire Red Carl Goldberg Ultracote. Having never used it before, I found it pretty easy to apply and, so far, it has been immune to sagging. The ABS cowl was left its natural, off-white color. A white CB/Tatone* plastic spinner and a pair of Sullivan SkyLite 3-inch-diameter wheels completed the ship.

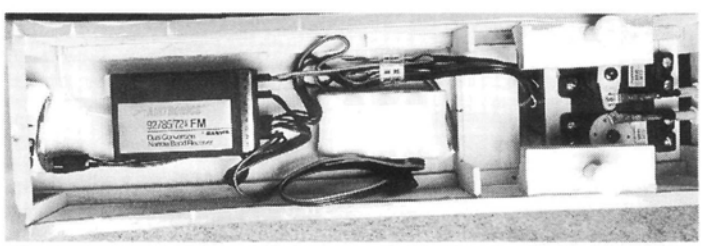
I installed a geared Astro Flight Cobalt 25 motor using the plastic Astro mount. I "fed" the motor initially using a 14-cell Sanyo 1200 SCR pack, and I later built a pack of 16 Sanyo 1700 SCRCs. I made the power wiring harness using Jomar* 12-gauge wire, Sermos* connectors and the new Sermos fuse holder with a 30A blade fuse. Metering the power to the Master Airscrew* 13x8 electric, wooden prop is an Ace* ST2635 microprocessor speed controller.

For the power-hungry, there's room enough under the hood for 20 cells (in two rows of 10 cells), making a geared, Cobalt 40 a real possibility. Expect a weight increase of about 9 ounces over that of the 16-cell, Cobalt 25 setup.

All-up weight with 14 1200s is 6¼ pounds, giving a comfortable wing loading of 21.4 ounces per square foot. With 4 pounds of thrust available from the power system, I knew it wouldn't take long to get into the air.

FLYING

The plane hadn't been flown when I took it to the Celebration of Silent Flight, so I asked CD and pilot extraordinaire Jerry Holcomb to do the honor of the maiden voyage. After checking the control hinges and linkages for security, he taxied onto the strip, advanced the throttle and, in no time, the ship was airborne. After a little up-elevator and a bit of right trim, he proceeded to wring the model out. In the next 3 minutes, he did smooth axial rolls; big, authoritative loops; a clean, one-turn spin; a four-point roll and more. Three quarters of a rolling circle topped things off! A graceful landing to recharge, and it was time to try my much more limited skills.



The bottom view of the equipment tray shows the throttle (barely visible on the left), the receiver, the receiver battery (all attached with Velcro®) and the tail servos.

Before my first landing with the Schneider Sport, I knew this was a plane I would fly a

(Continued on page 127)

Bonus!

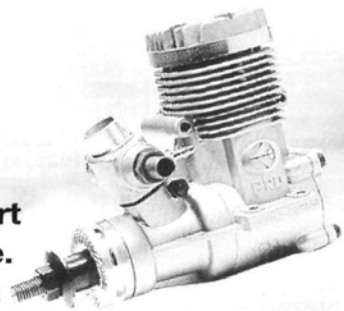
Get started in R/C

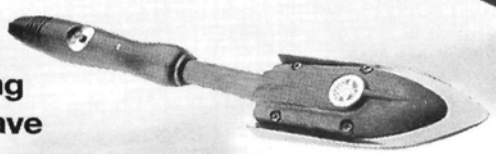
Buyers' Guide

If you want to get started in this rewarding hobby, but you're not sure what to buy, look no further! The "Get Started in R/C" Bonus Buyers' Guide is the first of four special-subject Guides that will appear over the next year. If you're about to buy your first model, if you're searching for a holiday gift, or if you just want to read up on the latest, hottest products, study these pages carefully. Choose from exciting trainer, sport, almost-ready-to-fly, electric, glider, ducted-fan and helicopter kits. Also, examine our two-page chart that lists the features of many popular trainers.

To build your first model, your fifth model or your hundredth model, you'll need more than an aircraft kit; so we've included much, much more—as our Table of Contents shows. Each product includes a photo or illustration and a part number (whenever possible) and a price. If you can't find the product you want at your local hobby shop, use the Index of Manufacturers at the end of this Guide and order directly.

We hope that you enjoy this exciting product catalogue as much as we have in bringing it to you. Good luck!





C O N T E N T S

MIDSIZE

Trainer Guide

IN ANY ACTIVITY or profession, there's a ground floor—a place where one's feet get wet. In aeromodeling, this is the domain of the trainer craft. Trainers are designed to make a first-time flier's experience pleasant, so they are easy to build and very forgiving in the air. Kit assembly is distilled to its simplest form, and many

Mfr.	Model name	Price	Construction	Wingspan (in.)	Wing area (sq. in.)	Engine req'd	No. of channels	Weight (lb.)
Lanier	Cessna	$109.95	ARF*	49	490	.25 to .40 2-stroke; .40 to .45 4-stroke	3	4
Lanier	Pinto	$109.95	ARF*	49	490	.25 to .40 2-stroke; .40 to .45 4-stroke	3	4
Lanier	Comet	$115.95	ARF*	63	630	.40 to .60 2-stroke; .48 to .90 4-stroke	4	5½
Lanier	Transit	$115.95	ARF*	63	520	.29 to .60 2-stroke; .49 to .60 4-stroke	3 or 4	5½
Lanier	Slo Comet	$115.95	ARF*	75	750	.40 to .60 2-stroke; .49 to .90 4-stroke	3	6
Altech Marketing	Sage 40	$135.98	ARC-BPF	60	600	.40 2-stroke	4	5
Direct Connection R/C	The Advance	$69.95	AWK-B	56	660	.40 2-stroke	4	5¼
Direct Connection R/C	Doodle Bug	$79.99	ARF-F	62	556	.049 Cox incl.	3	1⅞
Florio Flyer Corp.	Nifty 50	$64.95	AWK-BP	50	500	.15 to .28 2-stroke	3	3 to 3¾
Hobby Lobby	Telemaster 40	$79.50	AWK-BPS	73	848	.19 to .40 2-stroke	3 to 5	
Hobby Lobby	Senior Telemaster	$296	ARF-BPS	94	1,330	.60 and larger 2-stroke	4	10 ½
Hobby Lobby	Senior Telemaster	$139	AWK-BPS	94	848	.60 and larger 2-stroke	4	8½
Horizon Hobby	Easy Fly 40	$149.95	ARF-BP	643/4	712¼	.40 2-stroke; .45 4-stroke	4	4¾ to 5½
Midwest Products	Malibu 40	$94.95	AWK-BPS	603/4	730	.32 to .46 2-stroke; .40 to .50 4-stroke	4	5 to 6
Midwest Products	Aerostar 40	$109.95	AWK-BPS	62	675	.30 to .40 2-stroke; .40 to .50 4-stroke	4	5 to 5½
Major Hobby	Fantasy	$69.95	AWK-B	60	693	.40 to .61 2-stroke	–	5 to 5¼
Major Hobby	ET-40	$49.95	AWK-BP	62	682	.28 to .50 2-stroke	4	5
Sig Mfg.	Kadet LT-40	$104.95	AWK-BPS	70	900	.30 to .40 2-stroke; .40 to .50 4-stroke	4	5½ to 6
Sig Mfg.	Seniorita	$62.95	AWK-BPS	63	746	.15 to .25 2-stroke; .21 to .35 4-stroke	3	3¾
Sig Mfg.	Senior	$86.95	AWK-BPS	78	1,150	.29 to .40 2-stroke; .35 to .45 4-stroke	3	6
Sig Mfg.	Kadet Mark 2	$81.95	AWK-BP	57¼	635	.25 to .40 2-stroke	4	5
Sig. Mfg.	Kadet Junior	$57.95	AWK-BP	48	430	.15 to .25 2-stroke	3	3¾
Stream Inc.	Aqua Sport 40 (floats)	—	AWK-B	52	475	.32 to .46 2-stroke; .40 to .48 4-stroke	4	6¼
Stream Inc.	Akro Sport 40 (wheels)	—	AWK-B	52	475	.32 to .46 2-stroke; .40 to .48 4-stroke	4	5
Stream Inc.	Playmate 40	—	AWK-B	56	532	.35 to .45 2-stroke; .40 to .48 4-stroke	4	3½
Royal Products	Royal-Air 40T MK II	$141.95	ARF-B	64	736	.40 to .45 2-stroke	4	–
Robbe	Euro Trainer	—	ARF	60	660	.40 2-stroke	4	5½
Robbe	Progo	$199.95	ARF	62	612	.25 to .40 2-stroke	3 to 4	5¼
Pica	Rapier II	$69.95	AWK-B	54	615	.40 2-stroke	4	5

Construction Legend

ARF—almost ready to fly. ARF planes come mostly assembled, with covering (film or fabric) applied at the factory.

Hobby Shack—SST 40

Construction usually entails assembly of the major parts, e.g., fuselage, wing and tail, by glue or by various hardware. Unless noted specifically, an engine and radio equipment are not included.

ARC—almost ready to cover. The model comes mostly assembled, similar to an ARF, but without its surfaces covered. Choice of covering material and design is left up to the modeler. Once complete, no one will know that you didn't build the kit yourself!

Fold & Fly—particular construction method used by U.S. AirCore.

AWK—all wooden kit. May be of all-balsa construction or combinations of balsa, plywood and spruce. Typical example: balsa ribs, fuselage formers and sheeting; plywood engine bulkhead and gear plate; spruce spars and/or stringers, longerons.

The following denote actual materials for **ARF, ARC** and **AWK** models:
-B: balsa.
-P: plywood.
-S: spruce.
-F: foam (wings or fuselage).

companies offer planes that are nearly ready to fly right out of the box. This helps get newcomers up and flying in no time. Once airborne, the low wing loading and inherent stability of the trainer prevents common beginner mistakes from becoming costly disasters. Here, we've charted the features of 57 midsize trainers to help you pick the one that's right for you. Welcome to a great hobby, fellow modeler!

Mfr.	Model name	Price	Construction	Wingspan	Wing area (in.)	Engine req'd (sq. in.)	No. of channels	Weight (lb.)
Cermark	Red Arrow	—	AWK-B	55	554	.40 to .60 2-stroke	4	6
Cox Products	EZ Bee II	—	ARF	55	358	.049 incl.	2	1½
Cox Products	Thermal Hawk	$49.95	ARF	55	358	.049 2-stroke	2	1¼
Hobbico	SuperStar 40	$149.99	ARF-BP	60	660	.35 to .46 2-stroke; .48 to .70 4-stroke	4	5½
Tower Hobbies	Tower Trainer 40	$99.99	ARF-BP	60	660	.35 to .46 2-stroke; .48 to .70 4-stroke	4	5½
Great Planes Mfg.	PT-40 ARF	$169.99	ARF-BP	60	675	.25 to .40 2-stroke; .30 to .48 4-stroke	3 to 4	5 to 5½
Top Flite	Sierra ARF	$199.99	ARF-BP	60	660	.28 to .46 2-stroke; .40 to .60 4-stroke	4	5 to 6
Thunder Tiger USA	World Trainer 40T	$149.99	ARF-BPS	64	736	.40 to .46 2-stroke	4	6½
Thunder Tiger USA	World Trainer 40H	$149.99	ARF-BPS	60	600	.40 to .46 2-stroke	4	5
Thunder Tiger USA	Tiger Trainer 40	$149.99	ARF**	61	675	.35 to .46 2-stroke	4	5
Thunder Tiger USA	Eagle 30H	$127.99	ARF**	59	450	.25 to .36 2-stroke	4	4½
The Airplane Factory Inc.	Basic Trainer	$84.95	ARF	60	650	.40 to .46 2-stroke	4	5½
Global Quality Kits	Skylane 45-60	$99.95	AWK-B	72	700	.45 to .65 2-stroke; .61 to .70 4-stroke	4	7¼
Hobby Shack	SST 40	$64.95	AWK-B	57	625	.40 to .53 2-stroke; .48 to .61 4-stroke	4	5½
Hobby Shack	Right Flyer	$149.99	ARF-B	64	736	.40 to .53 2-stroke; .48 to .61 4-stroke	4	5½,40T
Model Tech	Joss Stik	$205	ARC-BF	67½	877	.60 to .90 2-stroke; .70 to 1.20 44-stroke	4	8½
Carl Goldberg Models	Falcon III	$109.99	AWK-BP	56	558	.35-.45 2-stroke; .40-.61 4-stroke	4	4-4½
Carl Goldberg Models	Freedom 20	$84.99	AWK-BP	55½	440	.20 to .30 2-stroke; .20 to .30 4-stroke	4	3¼ to 3¾
Carl Goldberg Models	The Eagle II	$99.99	AWK-BP	63	715	.29-.45 2-stroke; .40-.60 4-stroke	4	4¾ to 5¼
Byron Originals	Pipe Dream	$215.95	ARC	83	704	42cc gas; .60 2-stroke	3 to 4	10
U.S. Aircore	Aircore 40 Trainer	$119.95	Fold & Fly	64	704	.40 to .50 2-stroke;. 48 to .53 4-stroke	4	5¾
U.S. Aircore	Classic 40 Cub	$129.95	Fold & Fly	64	704	.40 to .46 2-stroke; .50 4-stroke	4 or 5	5¾
U.S. Aircore	Army Aircore 40	$129.95	Fold & Fly	64	698	.40 to .50 2-stroke; .48 to .50 4-stroke	4	5¾
U.S. Aircore	KnightHawk	$169.95	Fold & Fly	64	752	.40 to .50 BB* 2-stroke; .48 to .53 4-stroke	4	5¾ to 9
U.S. Aircore	Colt 40 SLT	$119.95	Fold & Fly	64 (58 Turbo)	704	.40 to .50 2-stroke;.48 to .53 4-stroke	4	5¾
Futaba	Professor 40	$189.95	ARF	59	540	.40 to .45 2-stroke	4	5¾
Bridi Aircraft Designs	Trainerkraft 40	$84.95	AWK-BP	56½	595	.30 to .45 4-stroke	4	4½
Bridi Aircraft Designs	4 Seasons 40	$91.95	AWK-BP	58	615	.40 to .60 4-stroke	4	4¾

** Lanier's ARF trainers are made from foam, ABS plastic, plywood, and balsa*
*** The Thunder Tiger Trainer 40 and Eagle 30H are made from BPS with ABS plastic cowling and upper cabin (turtledeck). ADDRESSES ARE LISTED ON PAGE 153.*

Number of channels needed

Horizon Easy Fly 40

The number of control surfaces and features, e.g., retracts, determines how many channels you'll need to control a model's flight. Expert pilots may need 7-channel radio systems, but beginners can enjoy flying with fewer. Basic control over the model can be achieved with just elevator/rudder or elevator/aileron, but most trainers are designed to fly with 3- or 4-channel radio systems. This allows control of the throttle and two or three control surfaces. As your skill increases, you may wish to upgrade to a more sophisticated airplane, in which case you may need a radio system with more channels and features. For this reason, it might be prudent to spend the extra money up front on a more capable system.

Wing area and wing loading

A wing's area is its top surface measured in square inches or square feet. The lower the wing loading, the more docile its performance will be. Generally speaking, the larger the wing area, the more lift the model will have. This allows the model to be flown more easily at lower speeds; this makes takeoffs and landings easier for the beginning R/C pilot.

A wing's loading is determined by dividing the model's weight in ounces by its wing area in square feet. To use the chart to determine wing loading, multiply the model's weight (as given in pounds) by 16 to find its weight in ounces. Then divide its wing area (as given in square inches) by 144 to determine its area in square feet. Example: a model that weighs 6 pounds (96 ounces) and has a wing area of 700 square inches (4.9 square feet) would have a wing loading of 19.6 ounces per square feet (96 ÷ 4.9)—very low, and quite good for a trainer.

Hobby Lobby—Telemaster

INDEX OF MANUFACTURERS

81, 84
AIRTRONICS INC.
11 Autry
Irvine, CA 92718
(714) 830-8769

86
AMBROSIA MICROCOMPUTER
98 W. 63rd St., Ste. 371
Willowbrook, IL 60514
(708) 655-0610
(708) 655-0610 (fax)

78, 85
BOCA BEARING CO.
7040 W. Palmetto Park Rd., Ste. 2304C
Boca Raton, FL 33433
(800) 332-3256
(407) 998-0119 (fax)

CAPSTONE R/C SUPPLIERS
562 W. Schrock Rd.
Westerville, OH 43081
(800) 593-5250
(614) 899-6070 (fax)

72, 73
CARL GOLDBERG MODELS
4734 W. Chicago Ave.
Chicago, IL 60651
(312) 626-9550
(312) 626-9556 (fax)

76, 78
CLANCY AVIATION
219 W. Second Ave.
Mesa, AZ 85210-1317
(602) 649-1534

87
COGSWELL ENGINEERING
2379 Wheatherwood
Corona, CA 91719
(909) 735-8679
(909) 278-3563 (fax)

86
COMPUTER AIRCRAFT DESIGNER
P.O. Box 1110
Sterling, VA 20167
(703) 476-2438

84
CONDOR R/C SPECIALTIES
1733 Monrovia Ave., G
Costa Mesa, CA 92627
(714) 642-8020
(714) 642-8021 (fax)

77, 80, 81
COVERITE
420 Babylon Rd.
Horsham, PA 19044
(215) 672-6720
(215) 672-9801 (fax)

76
COX PRODUCTS INC.
350 W. Rincon St.
Corona, CA 91720
(909) 278-1282
(909) 278-2981 (fax)

85
CS FLIGHT SYSTEMS
31 Perry St.
Middleboro, MA 02346
(508) 947-2805

81
DAN PARSON'S PRODUCTS
11809 Fulmer Dr., N.E.
Alburquerque, NM 87111
(505) 296-2353

72, 85
DIRECT CONNECTION R/C
Distributed by Capstone R/C Suppliers

77, 78, 80
DU-BRO PRODUCTS
P.O. Box 815
Wauconda, IL 60084
(708) 526-2136
(708) 526-1604 (fax)

84
ELECTRO DYNAMICS
9557 Crosley
Redford, MI 48239
(313) 534-6514
(313) 534-1390 (fax)

78, 79
FOURMOST PRODUCTS
4040 24th Ave.
Forest Grove, OR 97116
(503) 357-2732
(503) 357-2732 (fax)

85
FOX MFG. CO.
5305 Towson Ave.
Ft. Smith, AR 72901
(501) 646-1656
(501) 646-1757 (fax)

81, 82, 83
FUTABA
4 Studebaker
Irvine, CA 92718
(714) 455-9888
(714) 455-9899 (fax)

86
GHOSTS
665 Arkansas St.
San Francisco, CA 94107
(415) 824-7074
(415) 285-3656 (fax)

72
GREAT PLANES MFG.
Distributed by Great Planes Model Distributors

GREAT PLANES MODEL DISTRIBUTORS
2904 Research Rd.
P.O. Box 9021
Champaign, IL 61826-9021
(217) 398-6300
(217) 398-1104 (fax)

82
GUIDARI R/C INTERNATIONAL
170 University Ave. W., Ste. 12-103
Waterloo, Ontario, N2L 3E9
Canada
(519) 648-3033
(519) 746-8590 (fax)

86, 87
GULF STREAM AIR VIDEO INC.
P.O. Box 482
Hagan, GA 30429
(800) 531-1784
(912) 739-0031 (fax)

76
HANGAR 4 MODELS
Hamilton Dr., Unit 49-I
Ignacio, CA 94949
(415) 382-1141

72, 79, 81, 83, 84
HANGAR 9
Distributed by Horizon Hobby Distributors Inc.

82, 83
HITEC RCD INC.
10729 Wheatlands Ave., Ste. C. Santee, CA 92071
(619) 258-4949
(619) 442-1002 (fax)

72
HOBBICO
Distributed by Great Planes Model Distributors

84
HOBBYTECH INC.
34 Joslyn Dr.
Elgin, IL 60120
(708) 695-5903
(708) 837-6235 (fax)

HORIZON HOBBY DISTRIBUTORS INC.
4105 Fieldstone Rd.
Champaign, IL 61821
(217) 355-0022
(217) 355-0058 (fax)

80
INNOVATIVE MODEL PRODUCTS
P.O. Box 4365
Margate, FL 33063
(305) 978-9033
(305) 978-9041 (fax)

77
JD MODEL PRODUCTS
P.O. Box 386
Pacifica, CA 94044
(415) 359-0406
(415) 359-5833 (fax)

80
JEFFCO PRODUCTS
4858 Mercury St., Ste. 212
San Diego, CA 92111
(619) 467-9984
(619) 467-9993 (fax)

84
JOMAR PRODUCTS
3440 Riverhills Dr.
Cincinnati, OH 45244
(513) 271-3903

86
JR REMOTE CONTROL
Distributed by Horizon Hobby Distributors Inc.

77
LITE MACHINES CORP.
1132 Anthrop Dr.
West Lafayette, IN 47906
(317) 463-6253
(317) 463-6253 (fax)

72
MAIN PLANES
P.O. Box 582
College Pl., WA 99362
(509) 529-9256

72, 76
MAJOR HOBBY
1520 "B" Corona Dr.
Lake Havasu City, AZ 86403
(602) 855-7901
(602) 855-5930 (fax)

80
MATNEY'S MODELS
11326 Harold Dr.
Luna Pier, MI 48157
(313) 848-8195

84
MICROPACE INC.
P.O. Box 648
Northville, MI 48167
(810) 347-7654

87
MILT VIDEO LIBRARY
33 Lakefront Rd.
Putnam Valley, NY 10579
(914) 528-4117
(914) 528-7184 (fax)

79
MODEL PRODUCTS CORP.
P.O. Box 100
Allamuchy, NJ 07820
(908) 850-1508
(908) 850-8860 (fax)

87
MODEL VIDEO PRODUCTIONS
1222 26th Ave., N.E.
Olympia, WA 98506
(800) 789-7886
(206) 491-1333 (fax)

84
OMNIONICS
P.O. Box 684
N. Main St.
Peru, NY 12972
(518) 834-9437

76, 77
PIERCE AERO COMPANY
9626 Jellico Ave.
Northridge, CA 91325
(818) 349-4758

83
POLK'S MODELCRAFT HOBBIES INC.
346 Bergen Ave.
Jersey City, NJ 07304
(201) 332-8100
(201) 332-0521 (fax)

81
RA CORES
P.O. Box 863
Southbridge, MA 01550
(508) 765-9998

77, 78, 79
RAVE'S R/C DESIGNS INC.
3025 Silver Star Rd., Ste. 103
Orlando, FL 32808
(407) 292-0083
(407) 292-9801 (fax)

73, 77
ROYAL PRODUCTS CORP.
790 W. Tennessee Ave.
Denver, CO 80210
(303) 778-7711
(303) 778-7721 (fax)

86
SAITO SEISAKUSHO
Distributed by Horizon Hobby Distributors Inc.

79, 83
TEJERA MICROSYSTEMS ENGINEERING INC.
P.O. Box 340608N
Tampa, FL 33694
(813) 968-9510
(813) 968-9510 (fax)

86
THE RACER'S EDGE
101-A Hickey Blvd., #501
S. San Francisco, CA 94080
(415) 756-2214
(415) 757-1959 (fax)

87
THE SPYDER CO.
P.O. Box 7
Newton, NH 03858-0007
(603) 382-5142

87
THIRD COAST REALITY
20 Summit Dr., W.
Wimberley, TX 78676
(512) 847-9104

73, 77, 79, 85
THUNDER TIGER USA INC.
2430 Lacy Ln., #120
Dallas, TX 75006
(214) 243-8238
(214) 243-8255 (fax)

73
TOP FLITE
Distributed by Great Planes Model Distributors

81
TOTAL AERO-GRAPHIC SERVICES
2787 Stage Center Dr.
Memphis, TN 38134
(901) 386-7760
(901) 386-7676 (fax)

73
TOWER HOBBIES
P.O. Box 9078
Champaign, IL 61826-9078
(800) 637-6050
(800) 637-7303 (fax)

73, 76
U.S. AIRCORE
4576 Claire Chennault, Hangar 7
Dallas, TX 75248
(214) 250-1914

86
USR&D CORP.
P.O. Box 753
Hackettstown, NJ 07840-0753
(908) 850-4131

80
VARSANE PRODUCTS
546 S. Pacific St., Ste. C-101
San Marcos, CA 92069
(619) 591-4228
(619) 591-9211 (fax)

81
WAYTOGO MODELS
7 Linwood Ave.
Tewksbury, MA 01876
(508) 640-7926

80, 84
WINDWARD PRODUCTS
2098 B Walsh Ave.
Santa Clara, CA 95050
(408) 987-7734
(408) 987-7735 (fax)

84
ZZ ENTERPRISES INC.
631 Manchester Rd.
Norristown, PA 19403
(610) 539-7476

Descriptions of products appearing in this *Guide* were derived from their manufacturers. The information given here neither constitutes an endorsement by *Model Airplane News* nor guarantees product perfomance. When contacting a manufacturer about a product described here, be sure to mention that you saw it in the *Model Airplane News* Buyers' Guide.

SUKHOI

(Continued from page 49)

shafts were used for elevator pushrods, while a pull/pull cable (constructed from a Du-Bro* cable kit) was used for the rudder control. For initial flight testing, control surface throw was set according to instructions.

A Simple Smoke System* was installed—a simple procedure that uses the pump developed by Tejera Microsystems Engineering*. The pump and battery were secured under the cowl immediately aft of the front cowl support. There's ample room in the fuselage to accommodate an eight-ounce smoke-oil reservoir. Finally, a DGA* pilot figure, which had to be painted, and the engine, turning a 15x8 DynaThrust* propeller, were installed.

The canopy was glued into place with PFM (Innovative Model Products*), which is easy to work with because excess adhesive can be easily removed, and it bonds tightly to the Ultracote. After several failed attempts to align and glue the four-piece cowl together, I purchased a cowl and belly pan from Precision Fiberglass Products*. The Slimline* smoke muffler fits easily within the cowl. To ease the cowl attachment, the exhaust stacks were shortened by ¾ inch. Silicone tubing was used to extend the exhaust stacks through the cowl. The cowl fitting was completed by cutting openings to accommodate the muffler expansion chamber and a YS* cylinder head. Fitting the belly pan was easy and required very little cutting. I realized after purchasing the Precision Fiberglass Products* belly pan that it was identical to the one in the kit; the only difference was the construction. *[Editor's note: Carl Goldberg Models also sells a replacement fiberglass cowl for their Sukhoi kit.]*

The plans call for a flying weight of 8.75 to 9.5 pounds. Dry, my SU-26 came in at 11 pounds. The excess weight can be attributed to an additional servo for the elevator, a Tatone aluminum engine mount, the Simple Smoke System, a Slimline smoke muffler, smoke-fluid tank fittings and a Precision Fiberglass Products cowl and belly pan.

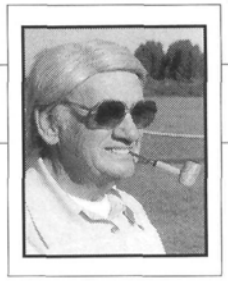
I'm really pleased with the SU-26. It's very responsive, predictable and is a smooth aerobatic airplane capable of all FAI procedures. Dave Patrick has designed a solid performer that's easy to build, looks sharp and has no inherent bad characteristics.

ACKNOWLEDGEMENTS

I wish to acknowledge the assistance of Leah Neumaier in the final preparation of this manuscript. Also, I'd like to thank my friends Jim Onorato and Dick Purdy for their assistance in adjusting the YS during flight testing and with photography. During the final preparation of this article, Dick

(Continued on page 114)

GOLDEN AGE OF R/C



HAL DeBOLT

MULTI-CHANNEL PIONEERS

THANKS TO John Voorhees, we were able to discuss the very early R/C of Clinton DeSoto and Ross Hull of the American Radio Relay League. True pioneers, they worked with gliders. Later ones were powered, and DeSoto reported on a cabin-style model that was very different in all respects (except appearance) to the trends of the day. That it was a success is demonstrated by its second-place finish at the '39 Nats.

THE FIRST FULL-HOUSE MULTI-CONTROL?

The report was titled, "The Latest in Radio Control" with a subtitle of "Radio control is the coming thing"! (Wasn't he *right?!)* An interesting clue to the state of R/C at that time is DeSoto's preamble: he envisioned being able to take off, perform aerobatics and land successfully at the takeoff site (all far in the future), and his report was intended to entice others into R/C. (Imagine having to do that!)

Apparently, the R/C concept became feasible when Robert Packard—a "ham" operator at Ratheyon Corp.—developed the RK 62 triode vacuum tube specifically for R/C. Its impact was as great as that of integrated-circuit chips, which replaced many transistors. DeSoto's original receiver required three tubes and associated components. In effect, the single RK 62 did the work of the three receivers.

Evidently, this project was an attempt by DeSoto to realize his dream or at least step toward it. I guess that this model could have been the first full-house multi-control R/C. What lengths pioneers would go to to reach their goals! This was a major effort!

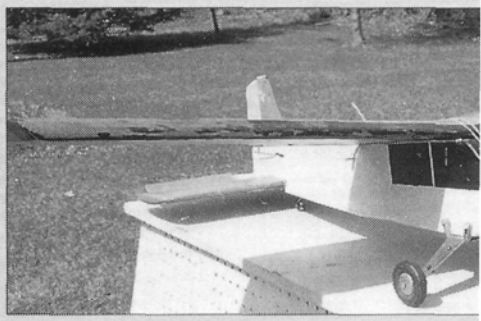
DeSoto and Hull's previous system could transmit a radio-frequency signal that the receiver accepted and then directed a motor-driven clockwork actuator to cycle. This time, they wanted full controls—rudder, elevator and ailerons—to cycle. This being far before reeds or compound escapements, the decision was made to use—in effect—four single-channel systems (one for each control!).

For simplicity, the four receivers were assembled on one board, and they drew from a common battery supply (this reduced weight). Coupling each antenna to its receiver was a sensitive procedure. The problem was solved by running one antenna along the fuselage top, another along the fuselage bottom and the remaining two out through the left and right wing panels. Had there been more antenna, a biplane might have been needed!

MIND-BOGGLING ACTUATORS

The way the actuators worked is mind-boggling. When a signal was sent, the control would move in one direction; release the signal and the control would stop *wherever it was.* To obtain the second control direction, you had to go through the first cycle again.The actuator had no neutral! You flew by watching the model in flight and noting its attitude. Like an underpowered free-flighter, it flew itself so to speak. Evidently, there

EVOLUTION—R/C STYLE!



For any modeling phase to move rapidly, it takes kits, proper engines, systems, etc., and we've already discussed how the Live Wire (LW) kit series opened the door for many.

Other outstanding early birds are:

- Guillow—Trixter Beam
- Midwest—Esquire Series
- Sterling—Tri-Pacer and, later, Mambo
- Berkeley—Royal Rudderbug

Surely, a mention of these kits brings back memories to many of you? Perhaps you have something to add?

Lou Andrews designed the Trixter Beam, and the thought and vision he put into it paralleled the efforts made to develop the LW Trainer. Like the Trainer, its design was functional and sturdy. Powered by a .09 engine and controlled by a C-S system, flights were consistently admirable. At an early Nats, Howard Bonner first displayed his prowess with a compound-

was time to decide which control to use, and this wouldn't have been a great problem with the original single-control glider; but imagine watching *three* control actions and remembering where *each* of the actuators was in its individual cycle (maybe OK on the bench, but under flight stress, *wow!*).

Four airborne systems obviously required a transmitter that was capable of broadcasting the four associated radio-frequency signals. As with the receivers, the four transmitters were assembled as a single unit and, in this case, the frequencies were spaced on the 50MHz ham band. Talk about inviting interference! The report indicates that there was some initial interaction of the controls, and it was eventually solved with more sophisticated circuitry. Antenna coupling was another problem; four "whip-style" antennas were mounted on a post at 90 degrees to one another (like our original TV antennas?).

The transmitters were operated from a separate control box much like some of the original reed systems. Four, "reed-style," telephone-type, toggle switches were "off," centered and "on" in each direction. Moving the toggle off-center energized that channel's signal. Confusion was reduced by designating the toggles as "right," "left," "up" and "down." In that way, even though you had to cycle the actuator through one direction to get to the other, at least you knew which direction you had last asked for!

Anyone who can recall their first reed experience will appreciate what confusion there must have been; it took much practice just to keep rudder and aileron plus engine and elevator controls separated, without having to worry about direction, too!

In size and structure, their model was typical of today's giant scale. It's truly amazing that its aerodynamics paralleled what's done today. They had no design experience to draw on, so they looked to full-scale aviation for guidance; they chose the Piper Cub as a proven layout and even kept the outlines for the sake of appearance. Sorry for the lack of decent photos. Does anyone have photos for us all to enjoy?

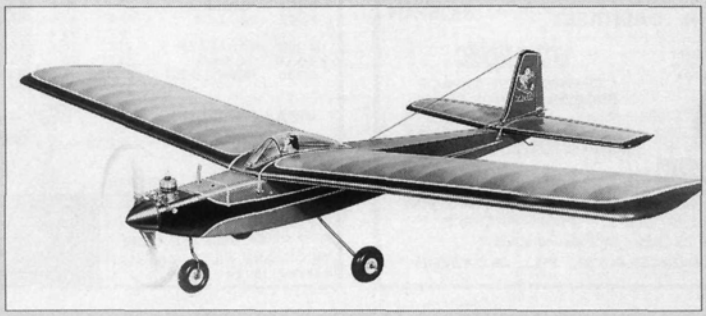
CUSTOM-BUILT TWIN

With a 14-foot wingspan and a 35-pound flying weight, adequate power was a definite need, but there was no apparent solution. It's too bad Quadra wasn't around! Fortunately, Forester Bros. came to their rescue with a custom-built twin. I'd guess that Forester joined two of their "99" cylinders to one case to obtain the ⅔hp DeSoto asked for. The report says that the twin was capable of a full 1hp, if needed (far from any of today's twins?). Its carburetor had high- and low-speed jets controlled by a butterfly valve à la an auto carb, and it apparently worked well.

The report is loaded with references to the difficulties of the times. Throughout the project, obtaining the necessary components was an unending chore. Obviously, the hobby shops had little beyond dope, tissue and Ambroid glue. It boiled down to searching the industry for what was needed. Reliable relays for the receivers and good spruce and light landing-gear material for the airplane had to be found. What a difference the passage of time makes! Today, it's easy to find what you need.

The report lacks flight descriptions (perhaps they thought that the model's details were of paramount interest), but we do know that the aileron systems had

(Continued on page 114)



Far left to right: Henry Webster's Lou Andrews-designed Guillow Trixster Beam. One of the first R/C kits, it was successful and widely used.

Carl Goldberg Models entered the R/C field early on with their Falcon Series of kits. The first was the large Senior Falcon, which was followed by the most popular, smaller .15 to .19 Falcon.

Midwest Products' early entry was the .09- to .15-powered Esquire, which was later followed by the Tri-Squire and Super Esquire—all well-accepted. This version was by Bob Williams of Vulcan, MI.

escapment-equipped Beam.

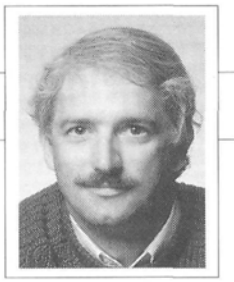
Frank Garcher and Midwest Products have always been on the leading edge of modeling development. Early on, their R/C offering was the Esquire Series. Good, solid designs of LW nature, they were very popular, and they led to considerable R/C success.

Sterling Models and Ed Manulkin were very active. Early on, their scale Tri-Pacer's performance was very acceptable, and later, their Mambo was widely received.

Carl Goldberg has never been one to miss the boat, as his offerings indicate today. An early offering was the Falcon Series, the first being the Senior Falcon—a large, shoulder-wing design that was readily accepted. It was soon followed by the Falcon, which was sized for .15 to .19 engines. This became the flagship of the line and was very popular. I bet that many of you cut your R/C teeth on a Falcon!

Though it's important to realize that R/C planes were designed by individuals, without the involvement of manufacturers, many designers would not have had the opportunity to enter R/C. Industry participation quickened the pace considerably!

AEROBATICS MADE EASY



DAVE PATRICK

TOC UPDATE

DID YOU know that the highly prestigious Tournament of Champions (TOC), which has been held in Las Vegas, NV, approximately every two years since 1974, offers the largest purse of any major aerobatics competition (full scale or modeling) in the world? This year, it's approximately $135,000! As I write, I am preparing for the '94 TOC, to be held October 27 to 30 (you will be reading this probably a week or two after it has been concluded). *Model Airplane News* will be offering full coverage of the event, but I'd like to offer some background on the latest TOC in advance of that article; the details may surprise you.

The TOC is sponsored by Bill Bennett, founder of Circus Circus and many other successful ventures. It is by invitation only, and the goal of the competition is to determine who are the best fliers in the world. The contest has an interesting twist: contestants must fly large-scale aerobatic models. Over the years, the TOC has proven to be a huge challenge to pilots and a spectators' delight.

Author Dave Patrick is almost hidden behind his new TOC competition aircraft—the Bucker Jungman. The huge model has 3,380 square inches of wing area, it weighs 39 pounds, and it's powered by a 140cc 4-cylinder, 2-stroke 3W engine turning a 32x12 prop!

THE PLANES

This year's rules have been modified to encourage even larger aircraft than have previously competed. This year, a 1-percent bonus has been added to the flight score for monoplanes with more than 2,200 square inches of wing area and for biplanes with more than 2,500 square inches. A 2-percent bonus was added for monoplanes with 3,000 or more square inches, and for biplanes with more than 3,300 square inches. Engine displacement is limited to 8.8ci (140cc).

What does this mean? Well, simply translated, how does a 40-percent, 40-pound, 9-foot-wingspan biplane turning a 32-inch propeller sound? Imagine such planes performing Lomcevaks and rolling circles; it will really be a big show!!

The event is even more interesting because the planes will use basically all new technology. Sure, big models have been flown quite successfully before, but not at the TOC's performance level. Weight will be a real concern, but not at the expense of strength. And how strong is strong enough? When preparing an aircraft, a contestant will have to ask questions such as: how big a spar should be used? How does one best mount such a huge engine? And which servos, hinges, control horns and props should be used?

By the time this event is over, we will have a lot of answers that can benefit everyone. What may seem like a somewhat esoteric competition will contribute technical solutions for the benefit of general modeling, much like auto racing can contribute to better cars for everyday use.

THE PLAYERS

To fly in the TOC, you need to be invited, and those 20 slots are really hard to come by. Simply put, the 10 best American pilots are determined by their placement in the U.S. Nationals and U.S. Team Trials. The 10 best international pilots are invited based on their performance at the World Championships in what is called "F3A," or international pattern rules.

THE MANEUVERS

Well, this is not for the faint of heart, and it was made this way on purpose. Steve Rojeki, the contest director and a TOC winner, has a good feel for what it takes to find the very best of this group of highly talented fliers. He has divided the contest into three basic groups that everyone must fly: the Known, the Unknown and the 4-Minute Free.

The maneuvers are basically what are used in full-size aerobatic competition and, in fact, some of the judges will be from the full-size competition arena. The maneuvers include combinations of loops and rolls, plus various snaps, rolling circles, spins and tail slides. Let's look at each.

• **The Known.** Everyone has been given the Known schedule well in advance and has had the opportunity to practice this group of maneuvers. The maneuvers are shown in the sidebar diagram.

• **The Unknown**. This group of maneuvers is basically the same as the Known; however, the contestant does not get to see what they are until the end of the flying day. He isn't allowed to practice, and he can only go through the maneuvers mentally. A big key to success here is teamwork with your caller. The pilot relies strongly on a clear calling of the maneuver at precisely the right time.

This is probably considered the most important aspect of the contest, i.e.,

doing well in the Unknown. You have the greatest exposure to error, and it can greatly affect your final standings.

• **The 4-Minute Free.** This may not be the most important from a strategic point of view, but it's certainly the most fun to watch!—so much so that it's considered a special event inside the TOC with a special trophy and prize money for the top three places. It's basically "anything goes," as long as it's safe. Pilots are allowed to use smoke, add music and even invent new maneuvers in an attempt to impress the judges. The criteria in judging the event are: originality, versatility, harmony and rhythm, and execution.

If you can attend only one part of the TOC, this is the one to watch. The pilots put on a wonderful show!

EFFORT

I decided to go all the way and shoot for the 2-percent bonus by building a large aircraft. After seeing what this translated into in actual dimensions, I concluded as a matter of practicality that a monoplane would be too large for me. I thought it might be easier to develop a biplane, especially from a structural point of view.

I considered the Ultimate as a subject, but finally decided on the Bucker Jungmann. This was only the beginning of what became a monumental task—one that could not have been accomplished without the help of many people. I would like to thank Dick Hanson,

1994 TOURNAMENT OF CHAMPIONS KNOWN COMPULSORY PROGRAM

Enter the box in level, upright flight.

1. At the center of the box; pull vertical and perform one aileron roll, followed by a second aileron roll in the opposite direction. At the top of the vertical line, perform a stall turn. On the down-line, perform three points of a four-point roll, followed by three points of a four-point roll in the opposite direction. Push to level, and exit inverted.

2. From level, inverted flight, push to vertical, and perform a stick-back (wheels down) tail slide. Pull to level, and exit upright.

3. From level, upright flight, perform a 1¼ negative-G snap roll to knife-edge. After a momentary hesitation, perform a 1¾ aileron roll in the opposite direction, and exit inverted.

4. From level, inverted flight, push to vertical, and perform a ½ aileron roll, followed by a ¾ aileron roll in the opposite direction, followed by a ½ outside loop (cross-box). On the vertical down-line, perform a 1¾ positive-G snap roll. Pull to level, and exit upright.

5. From level, upright flight, perform a two-roll rolling circle. First roll inward, then roll outward, and exit upright.

6. From level, upright flight, perform a 1½ aileron roll followed by ½ outside loop, with one negative-G snap roll at the top of the loop, and exit upright.

7. From level, upright flight, push to vertical down-line, and perform one aileron roll followed by a ¾ positive-G snap roll in the opposite direction and a second ¾ positive-G snap roll in the opposite direction of the first snap. Pull to level, and exit upright.

8. From level, upright flight, perform a ⅝ inside loop. On the 45-degree down-line, perform two, consecutive, two-point rolls. Push to level, and exit inverted.

9. From level, inverted flight, perform a ½ outside loop with a 1½ positive-G snap roll at the top of the loop, followed by a ½ inside loop, and exit upright.

10. From level, upright flight, pull to vertical, and perform a four-point roll, followed by a ¾ outside loop (Figure 9), and exit inverted.

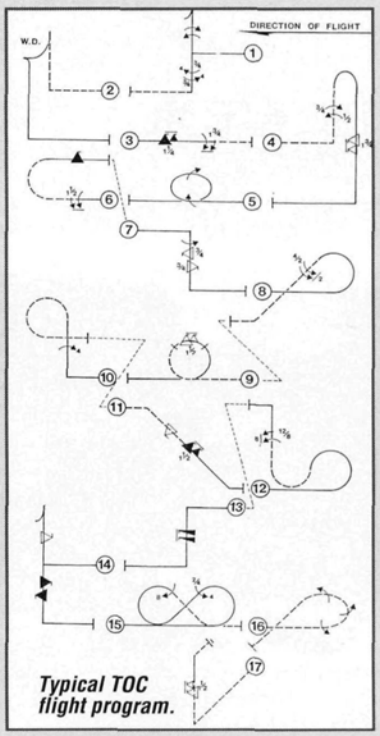
11. From level, inverted flight, pull to a 45-degree down-line, and perform one positive-G snap roll, followed by a 1½ negative-G snap. Pull to level, and exit upright.

12. From level, upright flight, perform a ¾ inside loop, followed immediately by a ½ outside loop and a vertical up-line. On the vertical up-line, perform a 12/8 point roll. Push to level, and exit upright.

13. From level, upright flight, perform a two-turn negative spin (cross-over spin). Pull to level, and exit upright.

14. From level, upright flight, pull to vertical and perform one positive-G snap roll. At the top of the vertical line, perform a stall turn. On the vertical down-line, perform one negative-G snap roll, followed by a second negative-G snap roll in the opposite direction. Pull to level, and exit upright.

15. From level, upright flight, perform a Cuban-8. On the first 45-degree down-line, perform two points of a four-point roll. On the second 45-degree down-line, perform an eight-point roll, and exit inverted.



Typical TOC flight program.

16. From level, inverted flight, perform three rolls of a four-roll rolling circle. All three rolls outward. Exit inverted (cross-box).

17. From level, inverted flight (cross-box), push to vertical up-line and perform a 1½ positive-G snap roll. Pull to level (cross-box), and exit inverted.

Exit the box in level, inverted flight (cross-box).

Bob Knoll, Steve Gawlick, Sue Patrick and Peter Woo for their many hours of help and Futaba* for their support.

As it now stands, the Bucker has 3,380 square inches and a 104-inch wingspan, and it weighs in at 39 pounds. Its wing loading is only 26.6 ounces per square inch. It's currently powered by a 140cc, 4-cylinder, 2-stroke, 3W engine on glow. I've done some preliminary bench testing, and it's very smooth with a simply awesome sound. A unique feature of this Bucker is its unbraced wing, which I hope can stand up to the rigors of TOC flying. We'll know soon!

IN CLOSING

An event like the TOC can't happen without Bill Bennett's support, as it takes a tremendous amount of financial backing, which he gives unconditionally. This may be a good time to mention that Bennett's interests in aviation are deep. They go back to being a pilot in the Navy and to flying various types of corporate aircraft and, of course, flying models. (He's pretty darn good at that, too. I've seen him fly very respectable maneuvers with his MK 1.20-size Chipmunk.) Till next time!

**Addresses are listed alphabetically in the Index of Manufacturers on page 153.* ■

TOC CONTESTANTS

USA

Chip Hyde, Henderson, NV
Bill Cunningham, Tulsa, OK
David von Linsowe, Mt. Morris, MI
Geoff Combs, Pickerington, OH
Steve Stricker, Baltimore, MD
Chris Lakin, Springfield, MO
Mike McConville, Hobart, IN
Jason Shulman, Winter Garden, FL
Mike Klein, Bedford, OH
Dean Koger, Xenia, OH
Gene Rogers, Ft. Worth, TX

INTERNATIONAL

Greg Marsden, Burlington, Ontario, Canada
Colin Campbell, Guelph, Ontario, Canada
Peter Erang, Schorndorf, Germany
Peter Wessels, Dorsten, Germany
Peter Goldsmith, Menai, Australia
Christophe Paysant-Laroux, Cherbourg, France
Quique Somenzini, Rio Cuarto, Argentina
Ken Binks, Eastbourne, Great Britain

PRODUCT REVIEW

Cannon Ultra-Micro R/C System

Cannon's smallest, most advanced system yet.

by JOE WAGNER

Though only ¾ the size of most R/C transmitters, Cannon's is equally powerful. Its smallness and light weight make it easy to hold. (The 3-channel transmitter is shown.)

THE LONG WAIT is over at last: Bill Cannon's new, super-light Ultra-Micro R/C System is in production !

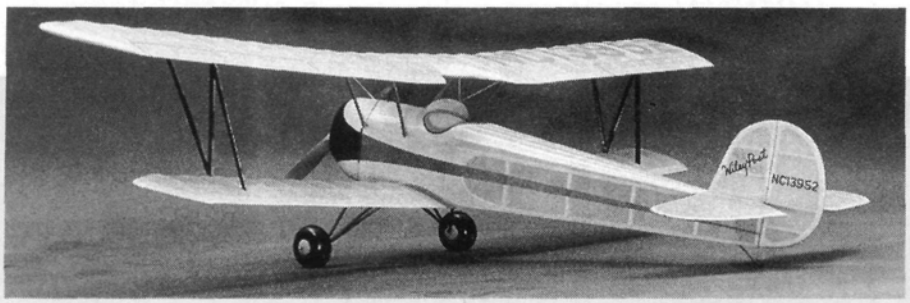
Cannon* began working on this system back in 1991. His goal was not only to make an R/C system that would be smaller and lighter than his world-famous Super-Micro R/C equipment, but also to meet the new narrow-band tuning requirements of the FCC's "1991 Standard." (Though pre-1991 Cannon transmitters can qualify for "gold stickers," the Super-Micro receiver wasn't quite capable of being converted to the post-1991 20kHz frequency spacing.)

A NEW LOADED CANNON

Cannon's Ultra-Micro system is only available in AM, and its receiver and servos are in separate housings. Its transmitter, which is inside a white plastic case that won't become scorchingly hot in the sun, resembles Cannon's earlier transmitters, but it has servo-reversing switches. Single-stick dual rates and mixing are also available for an additional cost.

The complete 3-channel Ultra-Micro airborne package easily fits inside a 2-ounce baby-food jar. Coincidentally, it weighs precisely 2 ounces.

The Ultra-Micro receiver features what Cannon calls "Dual-Balanced Mixer

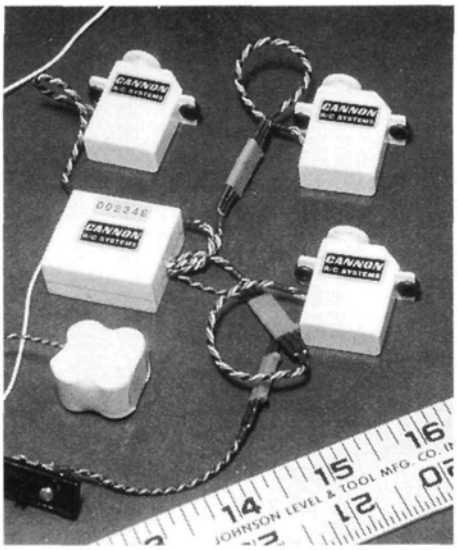


Think Small

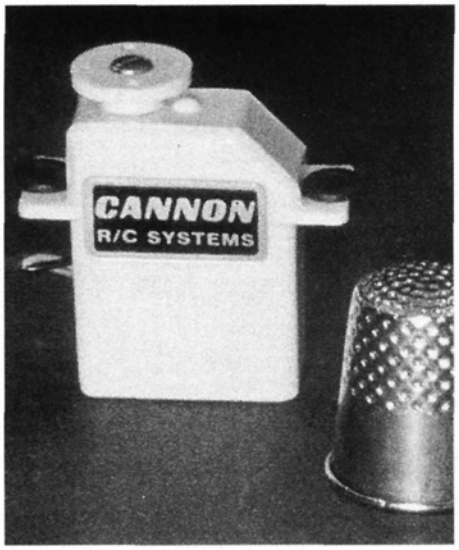
This little Wiley Post biplane is a great vehicle for the new Cannon Ultra-Micro R/C. Powered by a P.A.W. .03 diesel engine, the 2-foot biplane has throttle, rudder and elevator control.

For those who aren't familiar with the potential uses for Cannon's super-tiny, very light, proportional R/C system, I'd have the most fun flying it in a nearly scale, 2-foot-span biplane with a wing area of around 180 square inches and a ready-to-fly weight of about 10 ounces. Powered by a P.A.W.* .03 diesel with rudder, elevator, and throttle controls, this little two-winger is a terrific stunter that's capable of vertical climbs, too!

PHOTOS BY JOE WAGNER



A complete 3-channel Ultra-Micro flight pack. Smaller and lighter than Cannon's famous earlier Super-Micro equipment, this new R/C system has more features and better performance.



You can see how amazingly small the Ultra-Micro servo is by comparing it to a thimble. A new gearing system makes this one of the fastest-response R/C servos on the market.

Input"; he tells me that this improves RF noise rejection of electric motors. I especially like the thin, flexible, 24-inch-long antenna. It's easy to install in the minuscule models the Ultra-Micro system was designed to control.

To check the effectiveness of this short antenna, I set up the new Cannon system in an open field, on a plastic "crate" just far enough off the ground so that the hanging antenna didn't touch it. With my collapsed transmitter antenna pointing directly at the receiver, the Ultra-Micro system provided glitch-free control up to 170 feet away. Reliable range in the air will be at least 10 times that. I'm convinced that the Ultra-Micro system can control any of my mini R/C airplanes to the limits of visibility.

The Cannon Ultra-Micro receiver idle current is 25mA. Depending on the friction and air resistance it has to overcome in moving its control surface, each servo normally draws between 85 and 100mA while in motion.

With a draw this low, a 50mAh Ni-Cd pack capacity is more than adequate for two consecutive 15-minute aerobatic flights. Anyway, I routinely fast-charge my radio batteries at the field (via an Ace R/C* fast field charger) and can fly my Ultra-Micro system all day by recharging the receiver pack after every other flight.

IT'S WORTH THE PRICE

Some fliers have told me that they object to the system's price. Including the shipping charges, a complete Cannon 3-channel Ultra-Micro R/C system comes to almost $350. When you buy any Cannon product, however, you're getting what amounts to a custom-built unit. Cannon checks out every item and system he sells before he ships it.

Another noteworthy news item from Cannon: he has upgraded his well-known Super-Micro equipment. It's now called "Micro-Elite," and it fully meets the AMA's "gold sticker" requirements. A little larger and a trifle heavier than the Ultra-Micro system, the Micro-Elite costs a bit less.

**Addresses are listed alphabetically in the Index of Manufacturers on page 153.* ■

SPECIFICATIONS

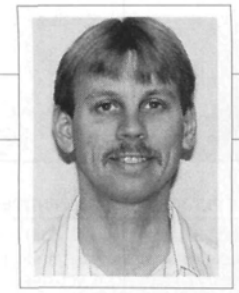
Receiver
- Dimensions—0.28x1.04x1.21 in. (plus the protruding "pigtails" for the servo and power connectors).
- Weight—0.41 oz. (2 channels); 0.5 oz. for each additional channel up to a maximum of five channels and a weight of 0.47 oz.

Servos
- Dimensions—0.44x1.21 in.; 1.35 in. overall height.
- Weight—0.30 oz. (each).

Battery Packs
- Weight—0.61 oz. (50mAh), 1.25 oz. (110mAh) and 2.12 oz. (275mAh); square and flat packs available.

Comments:
My new Ultra-Micro 3-channel airborne package, including a switch harness, a charge connector and a 50mAh Ni-Cd pack, weighs only 2 ounces, and it all fits comfortably inside a 2-ounce baby-food jar.

CENTER ON LIFT



MICHAEL LACHOWSKI

READING SITE CONDITIONS FOR BETTER LIFT

THIS MONTH, I want to talk about how the time of day when you fly changes your strategy and flight plans for finding and flying in lift. Then I want to show you some exciting new technology: prototypes of the all-molded Blackhawk sailplane. Although high-tech airplanes like the Blackhawk might have some performance advantages, if you can find the lift, all sailplanes go up.

READ CONDITIONS TO FIND LIFT

You should change your strategies for finding and working lift according to the time of day when you fly. How many times have you seen inexperienced pilots go back all day to the same place where they found lift in the morning? They didn't find any lift all afternoon. How often have you had to set up for an approach early after you had thought that you had plenty of altitude to make the time? The strong afternoon down air ruined your flight.

When I plan my flight strategy, the time of day is always an important factor, because the angle of the sun and the stability of the air change throughout the day. Stability is measured by something known as the lapse rate (the rate at which the air temperature decreases with altitude). The higher the lapse rate, i.e., the more the temperature changes for a given altitude, the more unstable the air; vertical motion and thermals increase. In addition, if temperature increases with altitude, you get an inversion, and the air becomes extremely stable with nothing rising through the inversion. Enough of the jargon; how can I get longer flights?

LOOKING FOR LIFT?

Here are some hints for "tuning" your flight plan when searching for lift.

MORNING
- The air is more stable.
- Lift is light—not much sink—but don't expect to get high.
- Minimize control inputs and fly smoothly.

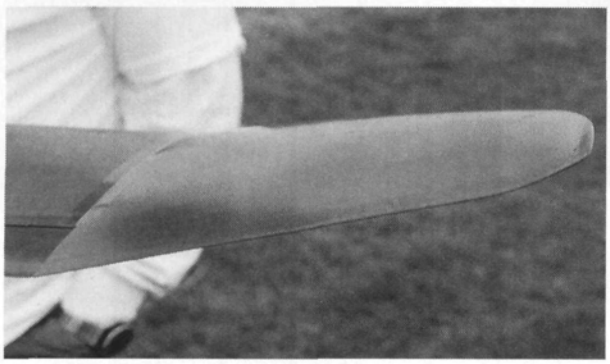
EARLY AFTERNOON
- Low-level thermals break through morning inversions; catch one and go!
- The air tends to be more unstable; plenty of thermals.

LATE AFTERNOON
- Thermals tend to become more scarce.
- There may be larger areas of sink; get out of it quickly!
- Fly around bad air.

In the morning, the first thing to consider is topography. Your best hope of finding lift is in areas that face the sun. If you're at a field and everyone goes to one location in the morning, take a walk over; I bet the area faces the sun. Of course, by noon and in the afternoon, other areas become much better thermal sources, and thermal activity over the morning area diminishes. Morning air is usually more stable. In addition, inversions that affect model soaring are more common in the morning. You can see this by how high the thermals take the sailplanes throughout the day. Quite often, you can characterize morning flights by light lift, not much sink and not much altitude. You can fly in the thermals rising from the ground, but they're stopped by an inversion. Near midday, the temperature is finally warm enough for the thermals to break through the inversion, and you can reach a much higher altitude.

In terms of morning flying strategy, keep control movements to a minimum, and don't worry about hitting some bad air. You should work the light lift carefully without expecting a rapid climb rate. It's harder to find bad air early in the day. If you happen to be flying in a contest with open winches, on the first round, wait until you see the thermal activity. To take advantage of the more favorable flying conditions that have lift and few areas of sink, fly the remainder of the morning rounds early.

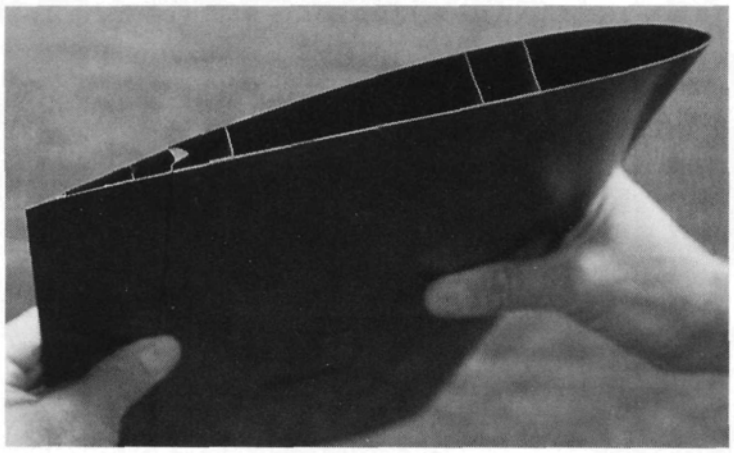
Around noon, you'll find the proverbial "noon balloon." Quite often, this is around the time when low-level thermals break through the inversion. If you ride one of these through the inversion, the whole sky seems to be going



The Blackhawk's curved wingtip is a work of art. Sophisticated CNC programming techniques had to be used to produce the continuous curve of the wingtip while maintaining its airfoil accuracy.

up—not much use in a thermal duration contest, but it's plenty of fun for sport flying, cross-country flying, or getting your LSF duration flights.

Now it's the afternoon. The sources of lift have moved, and the air is more unstable. By late afternoon, thermals will be more scarce. In addition, there may be larger areas of sink. Flight strategy has to change in these conditions. Now when you fly into sink, get out of it quickly. You can't afford the altitude loss of wallowing in it, because the next thermal may be farther away than it was earlier in the day. It's also more important to plan flight paths back from a thermal you followed downwind. When thermals are frequent, you can afford to fly straight back through the sink following that thermal. If you do that later in the afternoon, you're asking for an off-field landing. Pick a path to the left or the right, and be aggressive flying through sink, even though you want to just hang in there to get your max. When you launch in the afternoon, you need to be more sure of where lift is. Start out with a flight plan that includes a known thermal, a thermal you think just moved through or, if all else fails, a flight away from known bad air.



The Blackhawk's wing is molded of carbon fiber and Rohacell. The top and bottom surfaces don't have to be joined because they come out of the mold in one piece.

The prototype molded Blackhawk attracted plenty of attention at the World Soaring Jamboree (see November '94 issue). Dave Diesen explains some of the design and construction features. Ray Olsen (USA) stands in the background.

BLACKHAWK THERMAL SAILPLANE

Technology keeps marching on. At the World Soaring Jamboree, I had a chance to look at prototype parts of a new sailplane called the "Blackhawk." Michael Selig designed the model for Ray Olsen and David Diesen, who have developed some interesting construction techniques for the wing. At first, it appears to have the usual hollow-core construction with some nice molded parts for the flap's leading edge. Although the lay-up of carbon fiber and Rohacell is similar to that used in hollow molded wings, the Blackhawk's wing pops out of the CNC-machined molds in one piece. Yes, the top and bottom surfaces of the lay-up are put into the mold—with the shear webs—in one piece. Dave and Ray are working to patent this unique molding process.

The tip shape is interesting, and not something that's easy to do with wood construction. The tip-panel leading-edge is curved, and the last two inches of the wingtip curl up. Another interesting aerodynamic feature is the fuselage shape. The nose droops slightly to follow the streamlines around the airfoil. Because this model is designed to fly faster than Michael Selig's Opus, the droop isn't quite as pronounced. The Blackhawk should be good for F3J and Unlimited competition.

Wooden-wing prototypes of the Blackhawk have been flying for a while, and the first molded prototype has been flown by Joe Wurts. Now all we have to do is wait for them to set up manufacturing facilities. The unique wing-molding techniques greatly reduce the hand work required. By using "prepreg" carbon fiber and heat curing, the time required to produce a set of wings should be less than that taken to make conventional wet lay-ups. If it goes into commercial production, the kit will be handled by Slegers Intl.*—but don't call Ed to ask for one until its availability is announced.

Thanks to everyone for all the positive feedback on my columns. If you have any topics or items, the best way to reach me is through my Internet address: mikel@airage.com.

**Addresses are listed alphabetically in the Index of Manufacturers on page 153.* ■

SUKHOI

(Continued from page 89)

Purdy passed away. I wish to dedicate this Field & Bench review to him for his continual support, encouragement and friendship.

**Addresses are listed alphabetically in the Index of Manufacturers on page 153.* ■

GOLDEN AGE

(Continued from page 93)

to be eliminated to reduce weight to meet the Nats rules. The Nats win was intended to be proof of the pudding!

WHAT WAS THAT SMELL?

I couldn't remember what caused the "shoe polish" smell in OT fuels. Bob Beecroft of Carlsbad, CA, reminds me that it was nitrobenzene—a poisonous organic compound. Bob says that, years ago, free-flighters used it as a detergent in castor-based fuels. We control-line speed people used it as a retarder (like ethyl in gasoline) so that we could use more nitromethane without detonating. The "stink" hung like a fog over the C/L circles, so one can only imagine how many modelers might have been affected by it. You were among them?

I'll soon be discussing the advent of R/C pylon racing, and though I *do* have material, I could use your experience and any photos pertaining to this event. Can you help? Do remember, this is *your* OT R/C place! ■

HOW TO

Hull and Float Design

Part 2

by Andy Lennon

THE FOREBODY BOTTOM of a flying boat's hull or a water-plane's float is the major source of hydrodynamic lift and spray during the takeoff run. Its bottom shape, both lengthwise and crosswise, is important for good results.

Figure 1 provides typical forebody cross-sections of full-scale water aircraft. Type A "flat" is the most effective hydrodynamically, but it planes with heavy spray. Vee-bottoms (type B) absorb landing shock, but reduce effectiveness and have heavy spray. Types C, D and E are designed to reduce "pounding" on takeoff and landing. Type F "cathedral" is popular for motorboats; spray is well-controlled without external spray strips, which are fragile and cause high air drag.

Type G "suggested" combines the efficiency of the flat bottom with the spray control of the flared and cathedral types. Above all, its construction is both simple and rugged (as shown in Figure 2) and applies to both hulls and floats.

Afterbodies do not require spray strips; otherwise, construction is the same as that shown in Figure 2 and based on stressed-skin principles as in "Stressed Skin Design," *Model Airplane News* September and October '92.

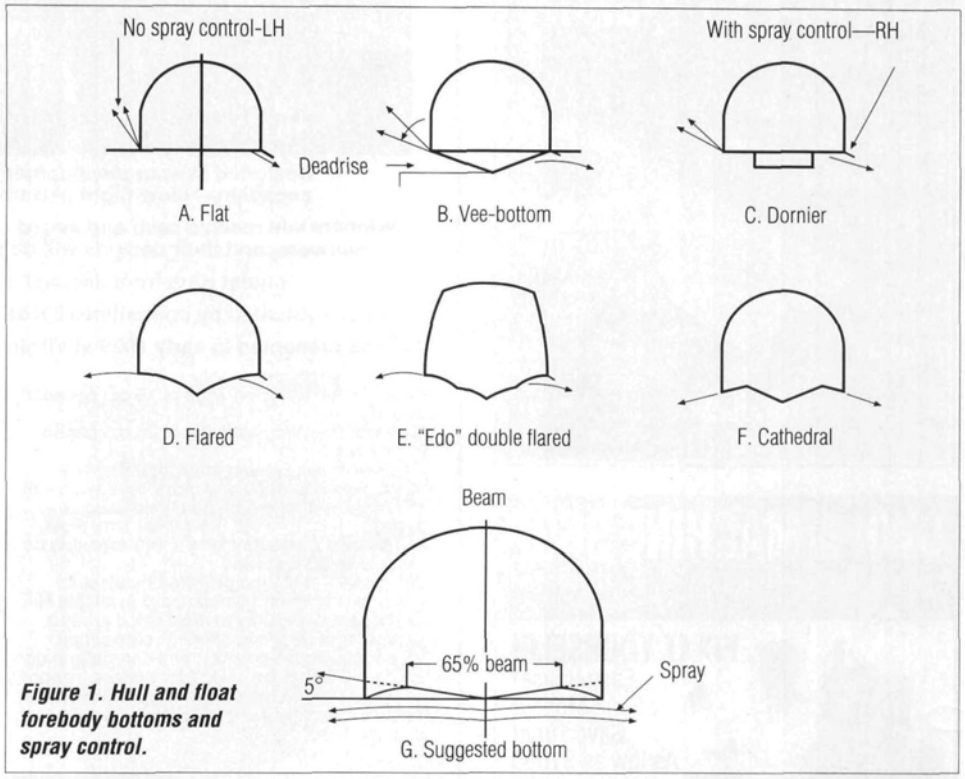


Figure 1. Hull and float forebody bottoms and spray control.

BOW CONTOURS

Bow contours for full-scale aircraft depend on the aircraft's function. Flying boats for heavy sea duty would have boat-like bows; for more moderate duty, bows may have a more streamlined shape. The type illustrated in Figure 3 has proven itself for model hulls and floats, and it's not difficult to make.

BUOYANCY

A cubic inch of water weighs 0.58 ounce. A model weighing 100 ounces would require a displacement of 100 ÷ 0.58, or 173 cubic inches, *plus* 100 percent reserve buoyancy, for a total of 346 cubic inches.

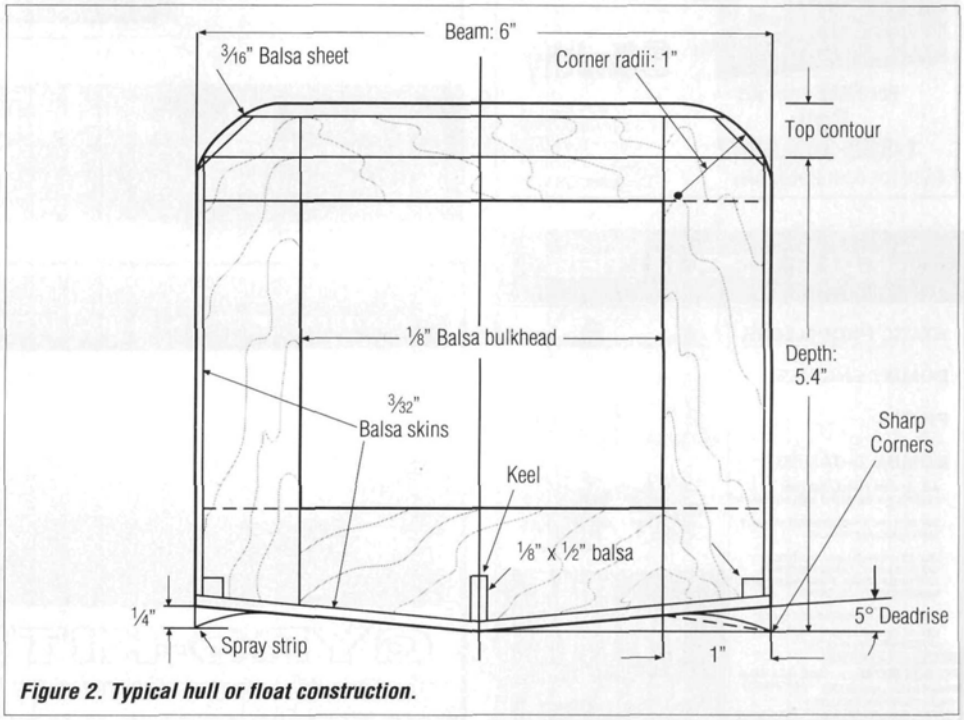


Figure 2. Typical hull or float construction.

The NACA models on which Figure 3 was based were designed with 100 percent reserves for a 94-ounce model (at the hull's lowest load). Adequate buoyancy is not a problem.

For twin floats, a maximum depth that's equal to the maximum beam and a length that's 60 to 70 percent of the airplane's length provide adequate buoyancy and reserves.

FLOAT OR HULL PROPORTIONS

Figure 3 provides proportions of both short- and long-afterbody hulls or floats. The short version, if used for a flying boat, would require an extension to provide an adequate tail-moment arm (TMA) for longitudinal stability. The long version provides such a TMA.

Knowing the hull's (or float's) total length and having arrived at the beam (as shown in Part 1), the dimensions of either version are easily calculated. Note that hull or float depths are based on the forebody length, and widths are in percentages of the beam.

For twin-float planes, the calculated beam is divided by 2 to provide each float's beam. Overall float length is 60 to 70 percent of the plane's length. The step depth is based on the total beam and is applied to each float.

WING ANGLE OF INCIDENCE

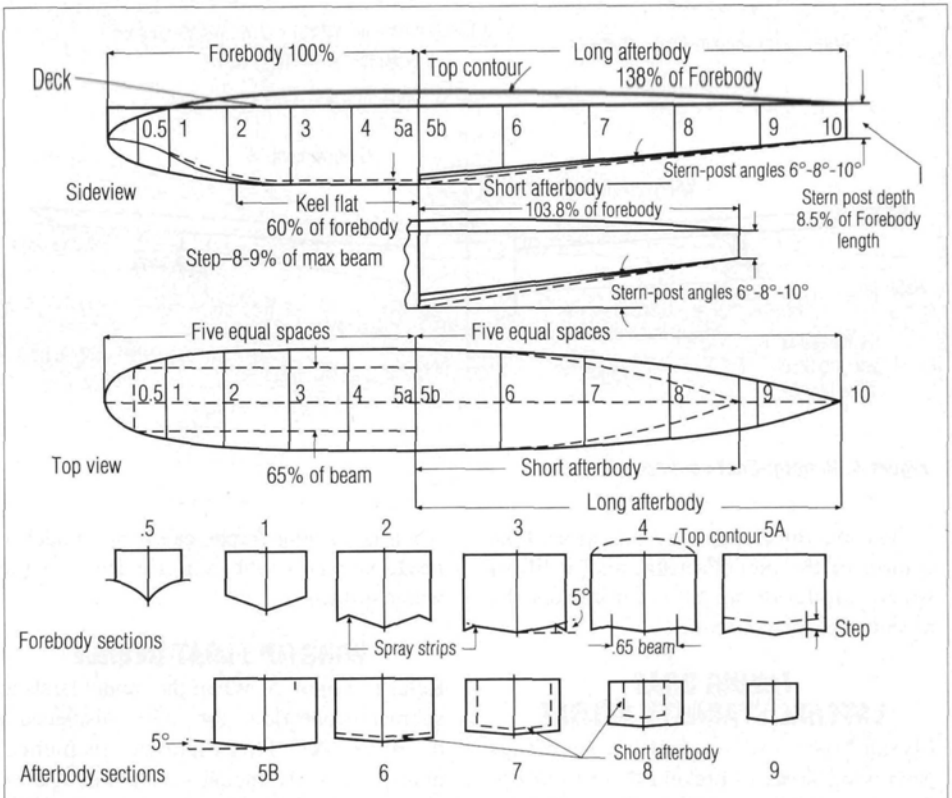
The article "Estimating Level Flight Speeds" in *Model Airplane News* (February '94 issue) provides the basis for calculating the angle of incidence necessary to provide adequate lift at the model's estimated level cruise speed. For the Seagull III (Fig. 4), this was 0.5 degree.

WINGS STALLING ANGLE AND HUMP TRIM

"Landing Gear Design, Part 1" in *Model Airplane News* (March '94) details the calculations necessary to arrive at the wing's stalling angle (at landing-speed Reynolds numbers, in ground effect and with flaps extended).

The Seagull III's net stalling angle during the takeoff run is 15 degrees. Since the wing is set at 0.5 degree in level flight, the stall would occur 14.5 degrees later.

The Seagull III's hull is the long-afterbody type with a sternpost angle of 10 degrees. Hump trim for this hull is 12 degrees; but because the forebody keel flat is set at *plus* 2 degrees for level flight, this model's *hump* trim angle is reduced to 10 degrees. With a wing stall at 14.5 degrees and hump trim of 10 degrees, there is a good safety margin—and wing stall at hump trim is avoided.



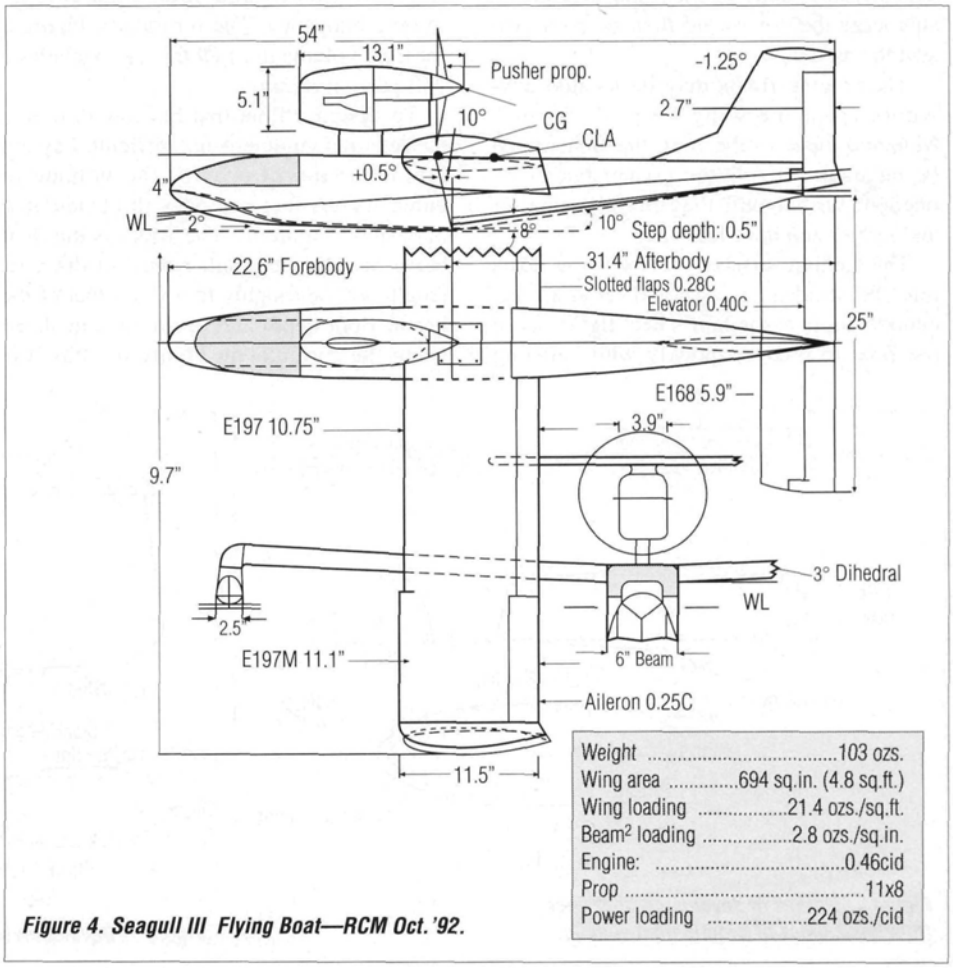
Forebody depths in percent of forebody length

Station	0	.5	1	2	3 to 5
Deck to chine	8.9%	11%	15.3%	22.5%	24.8%
Deck to keel	8.9%	17.5%	21.6%	24.8%	24.8%

Beam widths in percent of maximum beam at station 4

Station	0	.5	1	2	3	4	5A+B	6	7	8	9
Long afterbody	10%	59.6	74.7	88.8	97	100	99	96	87	68	37.3
Short afterbody	10%	59.6	74.7	88.8	97	100	99	93	75	38	-

Figure 3. Hull or float proportions



Weight	103 ozs.
Wing area	694 sq.in. (4.8 sq.ft.)
Wing loading	21.4 ozs./sq.ft.
Beam² loading	2.8 ozs./sq.in.
Engine:	0.46cid
Prop	11x8
Power loading	224 ozs./cid

Figure 4. Seagull III Flying Boat—RCM Oct. '92.

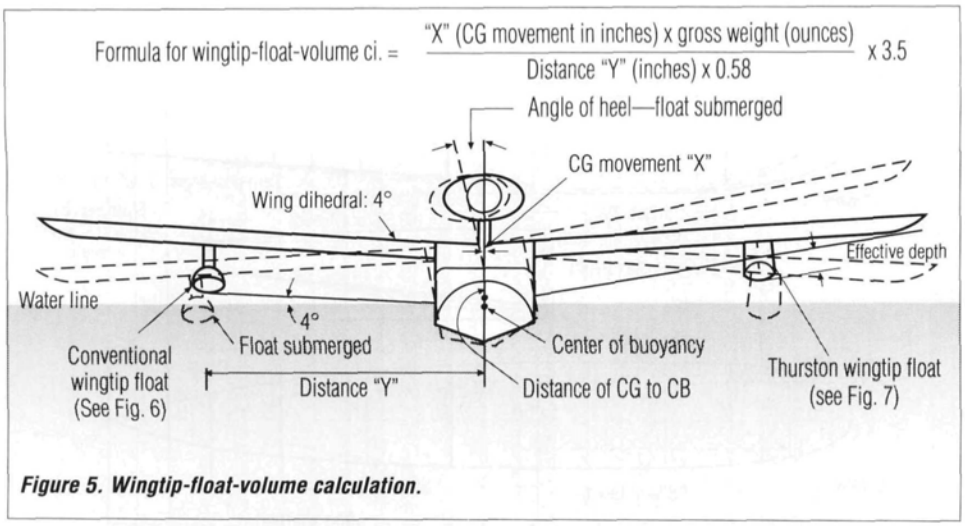
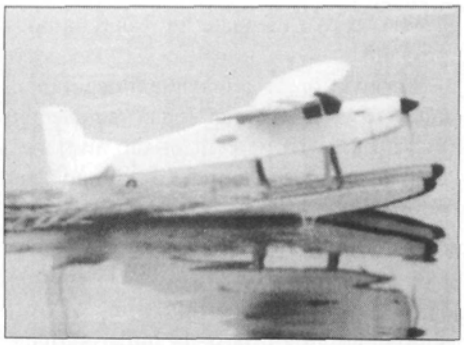


Figure 5. Wingtip-float-volume calculation.



Osprey planing at hump trim.

Beyond the hump, the elevators take control of the model's trim, and at liftoff speed, moderate up-elevator causes the model to become airborne.

FLYING BOAT LATERAL STABILITY AFLOAT

Flying boats and single-float seaplanes need wing floats to prevent them from tipping over. These must provide sufficient buoyancy to cover a situation in which the model is slowly taxiing crosswind with the hull (or single float) on the crest of a wave and the downwind float in a nearby trough. The upwind wing panel is elevated at a considerable angle to the wind, tending to submerge the downwind float or even capsize the model.

These wing floats may be located anywhere from the wing's tip to its root. Mounted close to the root, the floats must be larger to provide the greater buoyancy needed; farther out, they may be smaller and lighter and have less drag.

The planing surfaces of these wing floats must be of adequate area and set at a great enough angle to the hull's keel flat to cause the float to recover quickly while planing when disturbing forces cause the model to heel, lowering one wingtip float to the water surface.

WINGTIP FLOAT DESIGN

Refer to Figure 5. When the model heels to submerge one float, the CG is displaced a distance "X." This distance, in inches, multiplied by the model's weight in ounces, gives the unbalancing moment in inch-ounces. The corrective force is the buoyancy of the submerged float in ounces, multiplied by the distance from float center line to hull center line. The corrective buoyancy in ounces needs to be converted to cubic inches and increased for the reserve buoyancy. The formula in Figure 5 for float volume does all this and includes a 250-percent reserve.

To design a float that has low drag *and* the required volume is not difficult. Lay out a block that will provide the volume in cubic inches that provides the calculated buoyancy (Figure 6). The width is the float beam based on the hull beam^2 loading; its length will be roughly four times that of the beam. Both depth and beam are calculated using the formulas in Figure 6. Draw the three-views of your float in and around this block as shown. The float bottoms should be flat with sharp chine corners.

The float bottom should be set at 3 degrees to the hull's keel flat, as shown. Viewed from the front, the float bottom should parallel the water surface at contact for maximum recovery action when planing.

THE THURSTON FLOAT

The Seagull III incorporates the Thurston float at its wingtips. These are light and rugged, easily made using sheet balsa and have low drag. Figure 7 provides the basis for their design.

WATER RUDDERS

Water planes should have water rudders for directional control because the air rudder is ineffective when the plane taxies at low speed. The Seagull III has a water rudder at the base of the air rudder. The Osprey and Seahawk have water rudders operated by separate servos twinned to the receiver's rudder channel. All have good water control.

Happy dry landings. ■

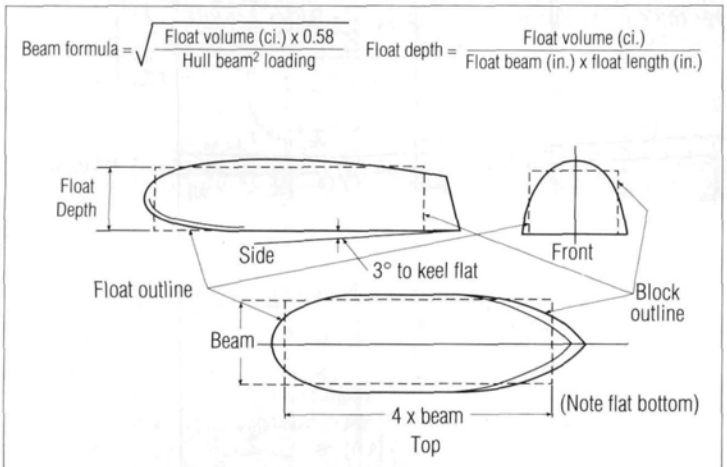


Figure 6. Method of developing float lines from basic block of wingtip float volume.

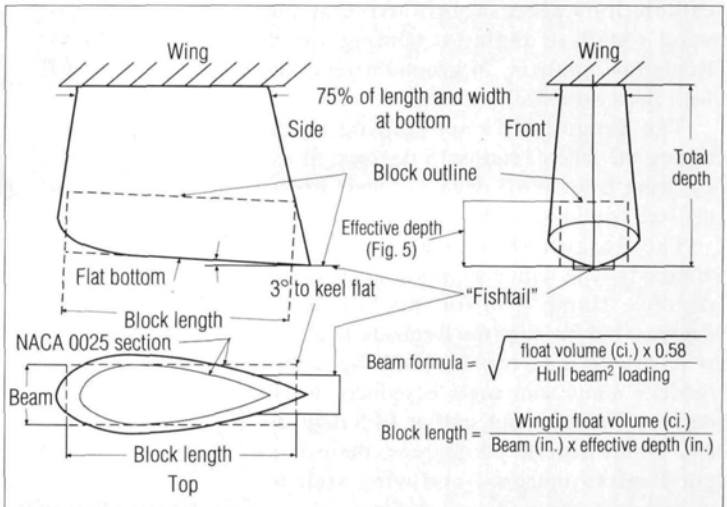


Figure 7. Development of "Thurston" float from basic block.

Windstar.

Introducing the sensational soarer that's quite literally, made for you.

FOKKER

(Continued from page 33)

re-mounted the struts approximately 1/8 inch inward on each side. To avoid this problem, future kits will have a modified rear landing-gear mount.

TAIL AND WING SKID ASSEMBLY

The tail and wing skids on the full-scale triplane were made of ash wood, and that's what they're made of on the model. The parts come shaped, needing only to be sanded to the final contour shown on the plans and fitted with the necessary brass fittings, screws and nuts.

The wing skids are fit on the lower wing after they've been covered and painted. Before covering, the functional tail skid is fit to the fuselage using bungee cord. Two coats of clear polyurethane are applied to the completed wooden skids.

FIBERGLASS COWL

One hundred and ninety eight brass rivets are applied to the face and trailing edge of the fiberglass cowl. To space the rivets easily and accurately, mark their positions on 1/4-inch-wide masking tape, making pencil marks 5/16 inch apart. Then simply apply the tape to the cowl's face and trailing edge as shown on the plans. A no. 60 drill bit is provided for drilling the rivet holes. The rivets are then glued into place.

The cowl is secured to the fuselage in exactly the same way as on the full-scale triplane: using two pin posts at the top of the cowl and a cable that wraps around in the molded groove at the cowl trailing edge. Threaded couplers are silver-soldered to each end of the cable, which uses two 2-56 nuts to keep it taut at the base of the cowl-mounting lugs. This is clearly illustrated on the plans.

INTERPLANE STRUTS AND MID-WING ASSEMBLY

The forward top deck from the rear of the cowl to the front of the cockpit is removable. The mid-wing and the four, pre-bent, aluminum interplane struts become one unit. When the model is covered and painted, the top wing will also become part of the unit, making the assembly more compact and easier to transport. The most important part of the interplane strut assembly is that, for proper flight performance, the angle of incidence on all three wings, including the sub-wing, must be plus 3 degrees.

CABANE STRUTS

The four outer-wing cabane struts are made of pre-shaped spruce and must be cut to size and fitted with aluminum fittings that are then glued into place with 1/32-inch-diameter brass rivets. The wooden struts are sanded and given two coats of clear polyurethane finish. The cabanes are true to scale and are functional, giving structural outer wing support.

RADIO INSTALLATION

Servos of standard size are used for the rudder, elevator and throttle, and two microservos are used for the ailerons. The rudder and elevator servos are mounted inverted directly under the pilot's seat, which may be removed to allow servo access. Adjustable control cables run directly from the servo arms to the elevator and rudder. The throttle servo is mounted in the upper wing panel, and the aileron extension wires run down the rear interplane struts.

The receiver is mounted directly under the fuel tank. A 1200mA SR* battery pack is mounted on the plywood cowl bulkhead to the left of the engine in a Styrofoam-insulated, plywood box.

COVERING AND PAINTING

The model is completely covered with Goldberg's* Colortex red fabric. It does

not require any doping or priming—a great asset for avoiding warping and saving weight in a model of this caliber.

The simulated rib stitching was done with RC-56* glue covered with strips of Colortex. This procedure is fully described in the construction manual.

The entire model was sprayed with two light coats of Top Flite's* Missile Red Lustrecoat, which is a close match to the color of the full-scale replica. This was followed by spraying the white insignia bands directly over the red base coat which, surprisingly, did not bleed through. The only priming that was required was on the fiberglass cowl and all the aluminum struts.

RIGGING CABLES

The undercarriage struts and the interplane struts require cable rigging for structural support. Turnbuckles, clevises and sleeves are silver-soldered together and adjusted to keep the cables taut.

SCALE DETAILING

The Oberursel engine is very visible, and for true scale effect, it should not be omitted. Part of the Williams Brothers*, 3-inch-scale Gnome cylinders was used to make the dummy Oberursel radial engine. The rest was scratch-built of 1/32-inch-thick plywood, basswood and assorted handmade parts. A good source of photos and engine drawings is the "Fokker Dr.I, A Windsock Datafile Special," available from Proctor Enterprises*.

One-quarter-inch-scale Spandau machine-gun kits and six, 5/8-inch-diameter vintage wheels, also by Williams Brothers, were used in the final scale detailing.

All the small lettering, the manufacturer's ID plate, the prop logo and the weight table are dry-transfer decals from Glenn Torrance Models. The Maltese Crosses are from Vinylwrite*, and the fuselage serial numbers and letters are from A&P Graphics*. The 26-inch axial display propeller is from Glenn Torrance Models (an 18x6 Master Airscrew* Classic Series prop was used with the O.S. 120), and the 1/4-scale WW I pilot is from Proctor Enterprises.

FLIGHT TESTING

Two CG locations are shown on the plans for proper balancing. Since the O.S. 120 used is lighter than the O.S. 160 twin used in the prototype, the model balanced at a point just in front of the rear CG.

The engine was shimmed to the recommended 1/4 inch to the right and 1/8 inch downthrust. Control throws called for the following:

- elevator—plus or minus 1 inch;
- ailerons—plus or minus 3/8 inch (inboard measurement);
- rudder—plus or minus 1 1/2 inches;
- radio mixing ailerons and rudder—rudder plus or minus 1 inch.

Very high weekend winds delayed the triplane's first flight; ironically, we were just three days shy of the anniversary of the date that Manfred von Richthofen was shot down and killed in this famous red triplane (serial no. 425/17).

The Suffolk Skyhawks Club graciously permitted me to use their spacious flying field for my test flight and photo sessions. Mike Gross—one of the club's seasoned scale fliers—was on hand for the initial test flight. After a thorough inspection and range check, the engine was started, and the triplane taxied out to the flight lane.

The wind was at approximately 8mph—straight down the runway. Mike slowly advanced the throttle and, almost immediately, the tail came up and the triplane was airborne in an amazingly short distance.

After an impressive climb-out to a safe altitude, control response was tested. One of the first things Mike noticed was that the elevator response was much too sensi-

(Continued on page 127)

FOKKER

(Continued from page 121)

tive, meaning that more nose weight was definitely needed. Coordinated ailerons and rudder were used for proper turning and banking.

After some slow flybys and low passes, it was decided that the sensitivity of the elevator made it a little too risky to do any further tests. Despite its sensitivity, Mike managed to land the triplane safely.

Eight ounces of lead was epoxied to the inside front of the cowl to arrive at the forward CG location. This brought the triplane's overall weight up to 15 pounds—still very light for a model of this size.

With the triplane re-balanced, the elevator response was ideal, and the overall flight performance was docile, although the landings do require some getting used to.

The following week, just back from Top Gun competition, Roy Vaillancourt of Vailly Aviation*, was on hand to fly the triplane so that I could take the in-flight photos. Roy is a good friend of Nick Ziroli and has flown Nick's triplane on many occasions. When I explained to Roy the type of photos I needed, I simply stood in the middle of the field while Roy flew figure-8s very slowly and at low altitudes all around me—some of the most realistic flying I have ever witnessed.

When the photo session was complete, Roy took the triplane up again to see what it could do. To the pleasure of all the spectators, he performed big, graceful loops, hammerhead turns and crisp aileron rolls. Landings were without a single bump. I felt as though I were at a Rhinebeck Aerodrome air show witnessing the late Cole Palen flying a showstopper triplane. Roy's excellent scale flying was *that* convincing.

CONCLUSION

Glenn Torrance's triplane is, by far, one of the nicest WW I ¼-scale kits available today. If worked on diligently, it can be built in as little as four months. An intermediate builder with some scale experience should have no problems at all. The triplane's contest record at Top Gun and its placing in the top 10 at the '92 Scale World Championships are a tribute to its realistic flight performance and scale accuracy. The kit would be a welcome addition to the hangar of any WW I scale enthusiast who loves to build and fly a *truly* scale model.

**Addresses are listed alphabetically in the Index of Manufacturers on page 153.* ■

SPORT 60

(Continued from page 68)

lot. It was smooth, responsive, obedient and predictable—a real confidence-builder. Using the 1200s, I get 4 to 5 minutes of pure aerobatic fun. The first flight using the 1700s lasted about 8 minutes with enough power left to taxi back up our 300-foot-long taxiway.

CONCLUSION

Having been a 3-channel flier for nearly 15 years and preferring small, light models, I felt that my flying skills had reached a plateau. To advance my skills, I needed something that was much more capable, but had enough manners to prevent me from being afraid of crashing. The Stream Schneider Sport 60-E fills the bill beyond my greatest expectations. It makes me look so good that I've gotten compliments wherever I've flown it. Because it looks so good, the 60-E gets compliments when it's merely sitting on the ground. In the hands of an intermediate or expert pilot, it is one of the most satisfying electric kits on the market today.

**Addresses are listed alphabetically in the Index of Manufacturers on page 153.* ■

SIMPLE PROGRAMMING

(Continued from page 12)

A button system could be configured two ways: either the button would activate a function temporarily while depressed, or it could turn a function on, and then depressing the same button again would turn it off. This idea would be most useful to those who fly with two fingers, or use a tray. Thumb fliers, however, might drop their bombs every time they get excited.

For scale fliers, the potential is obvious. They could fly through their routines, activating any special feature incorporated in their aircraft without having to abandon control for any period of time.

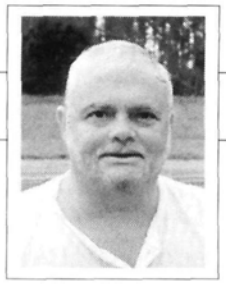
I would expect that pattern fliers would also have use for this type of system. They could activate speed brakes to control a maneuver without interrupting the flow of the maneuver.

Mark Bartley, *Dartsmouth, NS, Canada*

• **Closed Loop Comm Link.** The radio equipment in the airplane would transmit information back to the transmitter. Equipment of this type is starting to appear on the market, but no radio manufacturer has yet to embrace the concept. The flight-telemetry data that would be most useful would be engine temperature, rpm, fuel level, exhaust-gas temperature and

(Continued on page 155)

SPORTY SCALE



FRANK TIANO

OUR READERS' PROJECTS

I DON'T WANT to get too deeply into very much this month, but would rather like to bring you up-to-date on a couple of things and share some great readers' models with you.

GALVESTON '95

First, let me be the first to announce that Wiley Brown and Mike Wise of Hi-G Promotions* have announced that racing—Texas style—is definitely in the schedule for 1995. Mark July 10 to 16 on your calendar and attend—as a participant or as a racer, if you can. The host city is Galveston (same as last year); and as of this time, at least four classes will be raced: Unlimited, AT-6, Formula One and Thompson Trophy. Formula Ones are permitted to use 6ci engines.

For more details and specifications, catch the address for Hi-G Promotions in the Index of Manufacturers. Best of all, this Galveston race just may be the first in the country to include the new Midwest T-6 class. This is very exciting, and we will certainly keep you posted.

TOP GUN SET

Though for many it may seem that Top Gun has just ended, the wheels are already in motion for Top Gun 1995. The dates have been firmly set for April 27 through April 30, and the host club will once again be the Palm Beach Aero Club. As in the past, Palm Beach Polo and Country Club will provide the site and accommodations. Every year, I urge everyone to make reservations early, to take advantage of low airfares by booking way ahead of time, and to come join us in what has become the most prestigious scale event in the world.

The Helio Courier looks very realistic on the blacktop runway. Only the black nylon prop gives a clue that it's a model. All of Carlos Rangel's plans are drawn from factory blueprints.

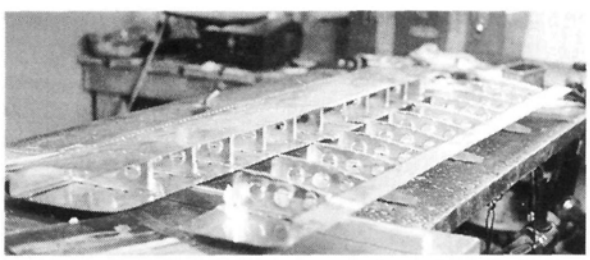
As many of you know, ESPN 2 featured Top Gun '94 in one of their segments. Once again, Cindy Burley of Southport will handle anyone's travel, off-site accommodations and rental-car needs. Call her, toll-free, at (800) 735-0401. For Polo Club reservations, call Douglas at (407) 798-7020.

Remember that at the last TG spectators witnessed the first turbine-powered scale model ever to compete in a scale competition? Well, for 1995, there's a good chance that we may see two of them. As in previous years, the major sponsors will be Pacer Technology and *Model Airplane News*. And remember, Top Gun is purposely orchestrated to be entertaining for all family members. Palm Beach has much to offer anyone who's looking for a relaxing vacation mixed in with a little model airplane stuff!

ALCLAD AIRCRAFT

For the first time in many months, I don't have any new products to talk about—although I'm sure that will change in the next few days! So until our next issue, I'd like to share several photos of some really incredible stuff. Some of the most interesting come from Carlos Rangel, an FAA-certified A&P mechanic and flight instructor living in Columbia, South America. For several years now, Carlos has been constructing R/C aircraft out of metal, and all of his designs have flown successfully. His first major scale project was finished in 1991. It is the 1/6-scale Helio Courier pictured here. What's

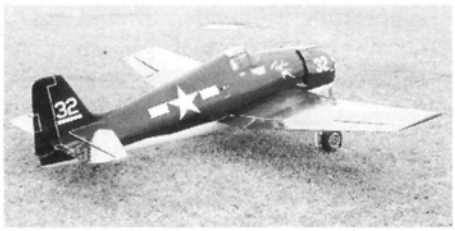
The 1/6-scale Pilatus Porter features a sliding door in its all-aluminum construction and is scheduled to fly in the spring of 1995.



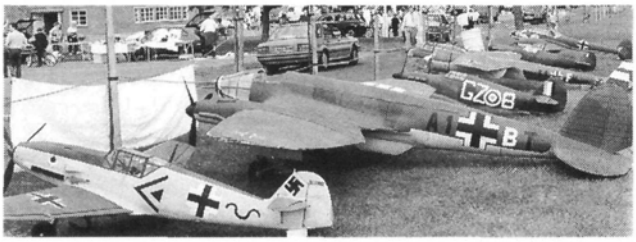
Just one of the Porter's wing panels shows flared lightening holes in each hand-formed rib. All parts were riveted together in a way that's common in full-scale aircraft.

J.R. Ziroli's huge P-40 on a photo pass really looks "dynamite." Nicky was showing off his new 3W two-cylinder in-line engine in the 34-pound Warhawk. It has been built just for fun flys; that's why J.R.'s initials (Nicholas A. Ziroli) appear on the fuselage sides.

amazing to me is that this 84-inch airplane weighs just 13 pounds. As you would imagine, it flies very well on an Enya .80 2-stroke engine. The Pilatus Porter spans 106 inches (weight is unknown at this time) and will be powered by a very husky Moki 1.8 engine. The metalwork is nothing short of fabulous on both projects, and what's really hard to believe is that all the aluminum is just 0.007 inch thick. That's right! The skin is so thin that the airplane must be handled very carefully to avoid punching one's fingers through the surface! The substructure's strength comes from the way the ribs and formers are formed with flanges around their perimeters. All the skins are riveted into place. I'm not sure if this is an example of a labor of love or maybe a love of labor! In any event, it's great work-manship.



One for the books! In a nutshell—or maybe we should say "bombshell"—Ben Meriwether's 1/5-scale Hellcat, built from Don Smith Plans, dove STRAIGHT down when its engine failed seconds after taking off. The engine buried itself in the ground; the fiberglass cowl disintegrated; and the plane bounced backward on its landing gear—with no other damage!



Peter Smith lives in England and builds nothing but WW II models—mainly British and German—of the types flown during the Battle of Britain. All are fairly large and use a lot of stick-and-tissue type of construction, only with bigger sticks, to keep the weight down. All of the models in this picture were built by Peter and all are 1/4 scale!

Until next month, check out the pretty pictures of what our readers are building. In the works are several interesting columns. Besides the one that deals with carbon fiber, one will answer many of the questions we get about PCM versus FM radios and which types of servos should be used in certain locations. Look for some serious sacred-cow slayings!

Your six is cleared.

**Addresses are listed alphabetically in the Index of Manufacturers on page 153.* ■

SAE AERODESIGN COMPETITION

by JAMES N. GIBSON

The overall winning team—Ohio State University—lifted 23.5 pounds

SAE INTERNATIONAL (The Engineering Society for Advanced Mobility Land Sea Air and Space) holds its annual Aerodesign Contest to provide budding engineers with a great learning opportunity and a place to strut their stuff. Teams from engineering schools design, build, and fly aircraft in an aerial "weightlifting" contest in which their designs are put to the test.

This competition shows these students what it's like to be engineers. The teams are judged not only on the weight their model can lift, but also on their engineering methodology. To be eligible, the planes must meet exacting specifications; and to win, the students must also receive good scores for their drawings, written reports and oral presentations. It's actually possible for the team that lifts the most weight to *lose* this competition—which, by the way, is what happened this year.

Seventy-nine teams from 57 schools entered this year's competition, which was held at Wright Field in Dayton, OH.

THE RULES

- Students must build a model aircraft that can carry a minimum of 8 pounds of cargo.
- The plane must use a K&B 0.61 engine burning 10-percent-nitromethane fuel and have a planform area that's no larger than 1,200 square inches.
- The cargo area must measure 10x6x5 inches and must have an aluminum cargo box.
- The vehicle must be able to take off using only 200 feet of runway; it must circle and then land on the takeoff strip.
- Repairs are restricted to the replacement of servos, engine parts or engine, wheels, and the odd connector (don't you believe it!).

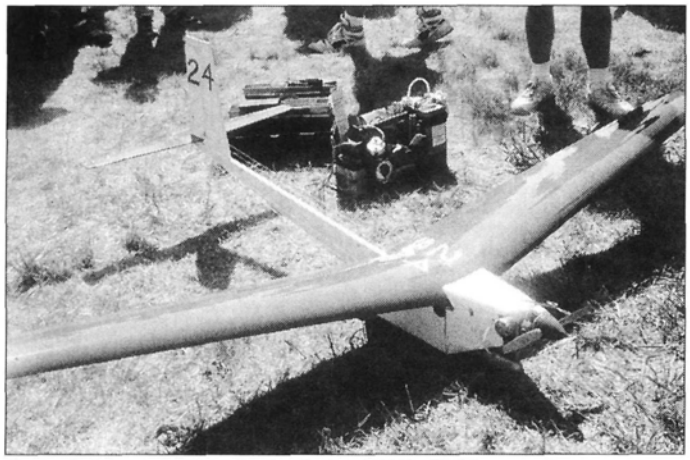
Outside these requirements, students may design the aircraft in any way they wish.

MEASURING THE COMPETITION

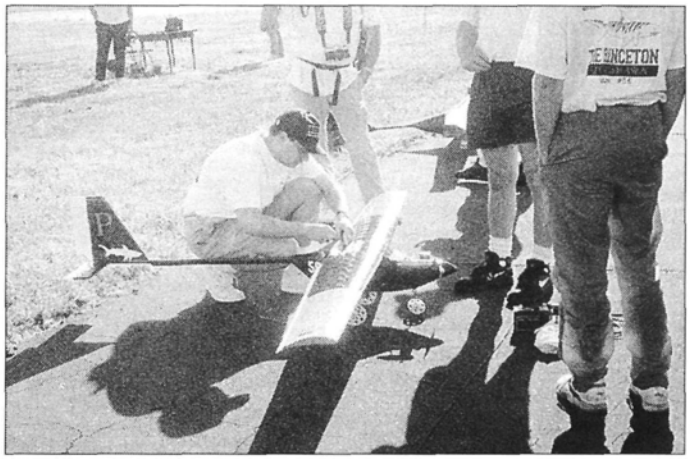
As in previous years, the competition featured an interesting collection of designs. Most of the teams had standard, high-wing, monoplanes. There were also Rutan-style aircraft; two lifting bodies; and two gliders with boxes. Even the standard designs varied from sleek racer types to baby guppies to miniature flying boxcars (Fairchild C-119).

In addition to the variety of designs, several aircraft had sophisticated aerodynamic features. Many had wingtip vortex suppressors to improve lift and reduce downwash. Slotted flaps were also common, and some had leading-edge lifting devices such as slots, slats, or built-in leading edge flaps.

Many teams used new materials and construction techniques. Among the old reliable wood and tissue aircraft, there were planes covered in Kevlar, carbon



Second place was taken by the Embry-Riddle "B" team, who lifted 24.5 pounds



Princeton University took fourth with this entry, which had to be rebuilt after an early crash.

fiber and even graphite. Foam-core wings and body parts were cut using computers, and some planes had components made by vacuum-bagging.

My school (California State University, Long Beach) first sent a team to this competition last year. The team was international in make-up, with members from South America, Nigeria, Jordan, France and the United States. It was also a team of neophytes who had never built an airplane from scratch or even *seen* an SAE contest. We didn't fare too well in '93, but we had learned a great deal since then, so we hoped to do much better. The vehicle that most influenced us this year was last years' winner from British Columbia.

If you wish to read some "gore," I'll tell you this much: at the downwind leg of the Wright-Patterson course, there's Cemetery Hill, where there's a downdraft that can make a plane lose altitude quickly. Many planes—including my team's—made unexpected landings there. A few more had in-flight radio problems, or overshot and ran off the edge of the runway. Surprisingly, only a couple had in-flight structural failures that caused a crash (this includes one plane that actually exploded in flight!). Take a look at the team summaries to get a feel for the diversity of entries. We'll be back!

SAE Aerodesign Results

Top five in overall scoring

1. Ohio State University
2. Embry-Riddle—Team B
3. Embry-Riddle—Team A
4. Princeton University
5. University of British Columbia

Top five in weight lifting

Team	Weight lifted (lb.)
1. U. of British Columbia	24.75
2. Embry-Riddle—Team B	24.50
3. Ohio State University	23.50
4. California State U.–Pomona A	22.00
5. Embry-Riddle—Team A	22.00

THE TEAMS

TEAM 51
Ohio State University

See photo on opposite page.
Style: high-wing monoplane with tricycle gear
Wing: span—104 in. approx.; chord—8 in. approx.
Airfoil type: FX74
Aerodynamic features: ailerons and slotted flaps
Weight (empty): 8 to 9 lb.
Propeller: 12x6 MS
Construction: fuselage is made of Kevlar. The wings are foam covered with fiberglass and MonoKote*; carbon-fiber spar. Ailerons are covered with carbon-fiber skin.
Standing: qualified for final round. Carried a minimum of 23.5 lb.
Opinion: a good standard design, though I'm surprised it did so well with only one wing spar. The *overall winner* at this year's competition.

TEAM 24
Embry-Riddle—Team B

See photo on opposite page.
Style: high-wing monoplane with tricycle landing gear
Wing: span—110 in.; chord—15 in. (tapered)
Airfoil type: FX63-137
Aerodynamic features: none
Weight (empty): 7lb.
Propeller: 12x6
Construction: standard, wooden, frame construction—both wing and fuselage; MonoKote for covering.
Standing: qualified for final round. Carried 24.5 lb. Placed second both in weight lifting and overall.
Opinion: an excellent design. The engine is mounted with downthrust, allowing level engine thrust with the wing at a positive angle of attack. The tail is mounted high to get it clear of propwash and to allow a fair amount of takeoff rotation. Finally, the vehicle is inherently stable in the roll axis, so ailerons aren't necessary.

TEAM 56
Princeton University

See photo on opposite page.
Style: high-wing monoplane with tricycle landing gear
Wing: span—8.5 ft.; chord—less than 9 in.
Airfoil type: Eppler 423
Aerodynamic features: ailerons only
Weight (empty): 5.8 lb.
Propeller: 12x6
Construction: the wing was made of wood with ribs and two ¼x½-inch spruce spars. Each spar was reinforced by a strip of carbon fiber on the bottom, and the whole construction was covered in MonoKote. The body was also a wood frame covered with MonoKote, while the tail boom was made from a carbon-fiber tube.
Standing: qualified for final round. On its first flight, carried a total of 18.5 lb.
Opinion: this aircraft and team deserve more then just fourth place. After a crash that heavily damaged the body, they rebuilt the vehicle and returned to the competition better than when they started. The vehicle's design facilitated repair and reconstruction. Though the Eppler foil is not one of the low-Reynolds-number foils, it was more then adequate for this competition. The six-pitch propeller also gave it good flight speed—an area in which many planes failed. The tail seemed too flexible and prone to twisting in the propwash. A raised tail might improve control, while ball-bearing wheels would improve roll.

TEAM 8
University of British Columbia

The "Monster" took first in weight lifting.

Style: high-wing monoplane with tricycle gear
Wing: span—109 in. approx; chord—9 in.
Airfoil type: FX63-137 (believed)
Aerodynamic features: built-in leading-edge flap and flaperons
Weight (empty): 6.5 lb.
Propeller: 13x6 four-cycle
Construction: wooden wing covered with tissue paper. Body made of plywood with a foam rear section. Tail boom made of wood.
Standing: qualified for final round. Carried a total of 24.75 lb.; placed first in weight lifting and fifth overall.

Opinion: Here it is—the Monster! This design has been used by UBC for three years straight, and it has never failed to carry the greatest payload. I can't say for sure why this design works so well (UBC wouldn't talk about their bird. They even had wingtip caps on it—"to protect the tips"—and blacked out the prop identification markings). My theory is that the tissue skin works as a turbulator, improving lift. It's also possible that they get a significant improvement in engine thrust by using the large, 4-cycle propeller.

TEAM 14

Cal. Poly Pomona–A

Style: high-wing monoplane with tricycle landing gear
Wing: span—112 in. plus; chord—about 8 in.
Airfoil type: FX63-137
Aerodynamic features: flaps, ailerons
Weight (empty)**:** 6.5 lb.
Propeller: 12x6
Construction: one-piece, carbon-fiber-covered foam wing with no spar. Body made of wood with foam rear fuselages and carbon-fiber tail boom.
Standing: qualified for final round. Carried 22 lb. Top five in lifting.
Opinion: their wheels needed low-friction bearings to increase takeoff speed. (They borrowed the bearings from Team 13 for their heavy lift.) Structurally, the vehicle needs work, particularly in the aft fuselage. The wing also needs work; the upper-surface carbon-fiber skin buckled during a flight.

TEAM 13

California State University Long Beach

Style: high-wing monoplane with tricycle gear
Wing: span—109 in.; chord—9 in.
Airfoil type: FX63-137
Aerodynamic features: slats, flaps, ailerons
Weight (empty): 6.1 lb.
Propeller: 13x6
Construction: fuselage made of carbon-coated balsa sheets covered with MonoKote; wing made of foam, covered with a layer of fiberglass, with a single carbon-fiber tube spar. Tail boom also a carbon fiber tube spar with balsa and MonoKote tail surfaces; gear strut of composite.
Standing: qualified for final round. Carried a minimum of 15 lb.
Opinion: if you think the tail is up to get it out of the propwash, think again. To use the leading-edge slats, this plane has to achieve an angle of attack of 15 degrees; to get such a high angle on takeoff requires a raised tail. I can't say much about this design because I'm a member of the team.

TEAM 36

University of Kansas–Team B

Style: canard, high-wing, lifting-body design with tricycle gear
Wing: span—9 ft.; chord—approx. 7 in.
Airfoil type: Worthman FX62-137
Aerodynamic features: canard, lifting body and vortex supressors
Weight (empty): 10 lb.
Propeller: two 10x5 APC
Construction: foam wings covered with fiberglass and MonoKote. Wooden body covered in MonoKote. Tail and canard booms made of aluminum tubing.
Standing: did not qualify for final round.
Opinion: an interesting design. The two small APCs* were connected by a toothed belt to the K&B 0.61. This engine was also directly connected to a small fan that rested between the canard booms (making starting easier).

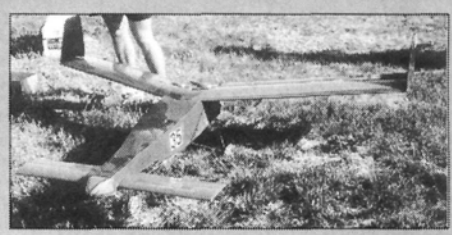
TEAM 4

University of Akron–"C"

Style: reverse-stagger canard
Wing: span—89 in; chord—7 in. approx
Airfoil type: main—SD 70-62; canard—Gottigen 769
Aerodynamic features: slotted flaps on canard; slotted flaperons on main wing; vortex supressors on main wing.
Weight (empty): 7.75 lb.
Propeller: 12x6
Construction: foam body covered with fiberglass. Wing and canard have an open-bay rib structure covered with fiberglass and including one wooden spar.
Standing: did not qualify.
Opinion: I liked this design for its beauty. I have to state, however, that there are some questionable aspects to it, e.g., the Gottigen airfoil on the canard. Most Gottigens are 150,000-plus-Reynolds-number (R_n) foils. On that small canard, an Eppler 61 with an R_n of 60,000 would have been better. Also, I'd use a pusher propeller instead of the K&B* reverser, to reduce the chance of the prop nut backing off.

TEAM 35

University of Kansas–Team A



Style: reverse-stagger canard wing pusher aircraft.
Wing: span—approx 100 in.; chord—7 in.
Airfoil type: Selig S-302IX
Aerodynamic features: flaps and vortex supressors
Weight (empty): 8.25 lb.
Propeller: 12x6
Construction: fuselage is wood covered with MonoKote; wings are foam covered with fiberglass and MonoKote
Standing: qualified for final round; carried a minimum of 8 lb.
Opinion: oh, yes, the dive bomber! The cargo box is loaded from below, making a very strong design. The vehicle also had good maneuverability, considering the three snap-rolls it made in its qualifing flight.

For further information on the 1995 SAE weight-lifting competition, contact: SAE International, Educational Relations Dept., 400 Commonwealth Dr., Warrendale, PA 15096; (412) 776-4841.

Tips for New Teams

Because more universities have shown an interest in sending teams to the 1995 SAE Aerodesign Competition, there will be *two* contests—

Aerodesign West—Mile Square in California (my area).

Aerodesign East—at Embry-Riddle University, Daytona Beach, FL.

Many new teams will be competing, and to help them get off to a great start, here are some suggestions:

• Plan to lift over 20 pounds (payload plus vehicle). Design for this type of load, and take enough weights.

• Use an airfoil designed for a low Reynolds number, such as a Worthman FX-63 or 72, or even an Eppler 66. In particular, if you use a canard or reverse-camber horizontal, use an airfoil designed for a lower Reynolds number than the one used on the main wing. This way, the main wing won't start to produce lift before the canard does.

• Have slotted flaps and, possibly, some form of leading-edge device. Even with a 100-inch span, you'll need all the lift you can get.

• To reduce in-flight drag and improve landing performance, try to have flaps that are adjustable in flight—light flaps on takeoff; heavy flaps on landing.

• Have your wing set up at about 5 degrees to your engine thrust line. This will help during the flight segment and produce little parasitic drag on takeoff. Remember, the wing will not encounter induced drag until it's moving fast enough to produce lift.

• Try a tapered wing. The longer root cord will reach the necessary lift Reynolds number more easily, while allowing you to have a high aspect ratio.

• Use hard wheels with either ball bearings or another type of bearing material. Balloon tires will burst, and hollow plastic ones will break, so use solid plastic or metal with a solid rubber tread.

• Use a steerable nose wheel or tail wheel. Rudder control is always poor on roll, particularly with the tail draggers, whose bodies blank out the tail. Also, on nose-wheel units, use a forked wheel strut to reduce the chance of it failing. Single wire struts tend to bend under load.

• Remember to have a strong main landing strut. Design it so that it doesn't bend under a load that's equal to 60 pounds of force hitting on one wheel.

• Almost any kind of material, including paper, may be used. Just make sure the structure can take the load and that you minimize wing twist. Example: during its last flight, Cal Poly Pomona "A" suffered a buckling failure in its carbon-fiber skin. As one would expect, it occurred in the upper surface skin, at the root.

• Try to use both a narrow-band transmitter and a narrow-band receiver on your vehicle.

• Use a large—13x6—propeller. You'll get good all-around performance. If you use a low-pitch prop, your takeoff thrust will be great, but your flight speed will be terrible.

• Try to keep your tail out of your propwash and out from behind your body and main wing. A raised tail may have structural problems, but it helps with control, and it prevents the tail from striking the ground on takeoff. Canard types don't have to worry about this.

Keep these facts in mind when you design your vehicle. I hope to see a number of new teams at the Mile Square competition. ■

CLUB OF THE MONTH

WEAK SIGNALS R/C CLUB
2325 Havencrest Ct., Toledo, OH 43611

As you can tell from their logo, the members of this month's winning club—the Toledo Weak Signals—have a great sense of humor, and their upbeat newsletter tells just how much fun an R/C airplane club can have. Along with "legitimate" contests for sailplane duration, pattern flying, pylon racing and Quickie 500, the Weak Signals sponsor a fun fly in which the participants undertake a bomb drop, a balloon burst and a spot landing. In another timed event, the "Dice Throw," each pilot takes off as soon as his partner rolls a seven and stays aloft until he rolls another seven.

In the August '94 issue of the club's newsletter, a column by Joe Visely reminds everyone that at the peak of the flying season, as always, "*Safety* is the most important thing! We should be checking our batteries, engines, bolts, servo screws, etc. Are we also becoming a little more daring in how and where we're making that low pass? Remember, take a little more time, and have fun!" We're glad to hear that the Weak Signals are as committed to safety as they are to enjoying the sport.

The newsletter also has helpful tips for dealing with servo wires and antennas in "Servo Wiring" and "Electronics News"—columns that were reprinted from other R/C club's newsletters.

In "From the President," Rick Lederman thanks members for "staying north of the creek, flying within our proper hours and avoiding flying power on Mondays"—all rules that were designed to keep the neighbors of the club's field happy. We applaud your endeavor to cooperate with the residents near your flying field; that's something every club must do to maintain access to its field and to help the sport to flourish.

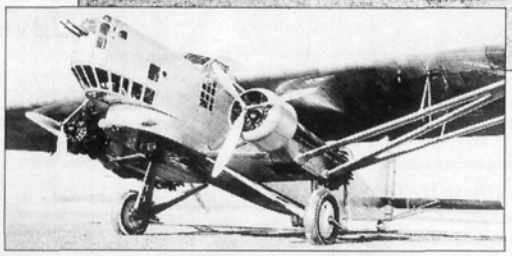
This club has also gained national recognition as the sponsor of the annual Toledo Weak Signals R/C Exposition.

Congratulations to the Weak Signals R/C Club! We hope you enjoy your two complimentary subscriptions to *Model Airplane News.* ■

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.



Congratulations to Raymond G. Biles of Big Stone Gap, VA, for correctly identifying the August '94 mystery plane. The French-built Farman F-221 was a four-engine night bomber powered by four, 700hp Gnôme-Rhône 14Kbr engines. The all-metal bomber had a top speed of 171.4mph and a maximum loaded weight of 39,160 pounds. The F-221 had a 118-foot wingspan and a crew com-plement of five. All bombs were carried internally.

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News**. If already a subscriber, the winner will receive a free one-year extension of his subscription.

INDEX OF MANUFACTURERS

Ace R/C Inc., *116 W. 19th St., Box 511C, Higginsville, MO 64037; (816) 584-7121.*

Airtronics Inc., *11 Autry, Irvine, CA 92718; (714) 830-8769.*

A&P Graphics Inc., *42A Nancy St., W. Babylon, NY 11704.*

Altech Marketing; *P.O. Box 391, Edison, NJ 08818-0391; (908) 248-8738.*

APC Props/ Landing Products, *P.O. Box 938, Knights Landing, CA 95645.*

Astro Flight Inc., *13311 Beach Ave., Marina Del Rey, CA 90292; (310) 821-6242.*

Balsarite; *by Coverite, 420 Babylon Rd., Horsham, PA 19044.*

Bridi Enterprises, *23625 Pineforest Ln., Harbor City, CA 90710.*

Byron Originals, *P.O. Box 279, Ida Grove, IA 51445.*

Cannon R/C Systems, *2756 N. Green Valley Pkwy., Ste. 405, Henderson, NV 89014.*

Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651; (312) 626-9550.*

CB/Tatone, *21658 Cloud Way, Hayward, CA 94545.*

Cermark Electronic & Model Supplies, *107 Edward Ave., Fullerton, CA 92633.*

Coverite, *420 Babylon Rd., Horsham, PA 19044; (215) 672-6720.*

Cox Hobbies, *350 W. Rincon St., Corona, CA 91720.*

Dave Brown Products, *4560 Layhigh Rd., Hamilton, OH 45013.*

Desert Aircraft, *P.O. Box 18038, Tucson, AZ 85731.*

DGA Designs, *16 Main St., Phelps, NY 14532.*

Direct Connection; *distributed by Capstone R/C Supplies, 562 W. Schrock Rd., Westerville, OH 43081; (800) 593-5250; fax (614) 899-6070.*

Don Smith Plans, *2260 N. Dixie Hwy., Boca Raton, FL 33431.*

Du-Bro Products, *P.O. Box 815, 480 Bonner Rd., Wauconda, IL 60084.*

DynaThrust Props, *Box 91, Georgetown, TN 37336; (615) 476-2330.*

Eldon J. Lind, *3151 Caravelle Dr., Lake Havasu City, AZ 86403; (602) 453-7970.*

Florio Flyer Corp., *P.O. Box 88, 149 Scotland St., Dagus Mines, PA 15831.*

Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718; (714) 455-9888.*

Glenn Torrance Models, *1404 Falls Church Rd., Raleigh, NC 27609.*

Global Quality Kits; *distributed by Hobby Shack (see address below).*

Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300.*

Harry B. Higley & Sons, *433 Aquilla Dr., Glenwood, IL 60425.*

Hi-G Promotions Inc., *P.O. Box 219181, Houston, TX 77218-9181; (713) 656-3139.*

Hobbico/Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*

Hobby Lobby Intl., *5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444.*

Hobby Shack/ Global Hobby, *18480 Bandilier Cir., Fountain Valley, CA 92728.*

Innovative Model Products, *P.O. Box 4365, Margate, FL 33063; (305) 978-9033; (800) 780-3190 —orders only.*

J'Tec, *164 School St., Daly City, CA 94014.*

Jomar, *3440 Riverhills Dr., Cincinnati, OH 45244; (513) 271-3903.*

JR; *distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.*

K&B Mfg. Inc., *2100 College Dr., Lake Havasu City, AZ 86403.*

Lanier RC, *P.O. Box 458, Oakwood Rd., Oakwood, GA 30566.*

Major Hobby, *1520 "B" Corona Dr., Lake Havasu City, AZ 86403; (602) 855-7901; fax (602) 855-5930.*

Mark's Model Building, *133 Bayard St., Kane, PA 16735; (814) 837-9435.*

Master Airscrew; *distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742.*

Midwest Products Co., *P.O. Box 564, Hobart, IN 46342.*

Model Tech; *distributed by Hobby Shack (see address above).*

MonoKote; *distributed by Great Planes Model Distributors (see address above).*

Nick Ziroli Models, *29 Edgar Dr., Smithtown, NY 11787.*

O.S. Engines; *distributed by Great Planes Model Distributors (see address above).*

P.A.W.; *distributed by Carlson Engine Imports, 814 E. Marconi Ave., Phoenix, AZ 85022-3112; (602) 863-1684.*

Pica Enterprises Inc., *2655 N.E. 188th St., Miami, FL 33180.*

Precision Fiberglass Products, *2805 Big Bend Dr., Maryville, TN 37803.*

Proctor Enterprises, *25450 N.E. Eilers Rd., Aurora, OR 97002.*

Rev-Up; *distributed by Progress Mfg. Co., P.O. Box 1306, Manhattan, KS 66502.*

Robart Mfg., *625 N. 12th St., P.O. Box 1247, St. Charles, IL 60174; (708) 584-7616.*

Robbe, *2655 N.E.188 St., Miami, FL 33180; (305) 932-1575.*

Royal Products Corp., *790 W. Tennessee Ave., Denver, CO 80223; (303) 778-7781.*

Sermos R/C Snap Connectors Inc., *Cedar Corners Station, Box 16787, Stamford, CT 06905.*

Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*

Simple Smoke System, *made by Tejera Microsystems Engineering Inc. (see address below).*

Slegers Intl., *Rte. 15, Wharton, NJ 07885; (201) 366-0880.*

Slimline Mfg., *P.O. Box 3295, Scottsdale, AZ 85257.*

Spring Air Products, *P.O. Box 37-3218, Satellite Beach, FL 32937; (407) 728-9002.*

SR Batteries Inc., *Box 287, Bellport, NY 11713.*

Stream Inc., *P.O. Box 1113, Newport News, VA 23601-0113.*

Sullivan Products, *1 North Haven St., Baltimore, MD 21224.*

Tejera Microsystems Engineering Inc., *P.O. Box 340608, Tampa, FL 33694; (800) 729-9210.*

The Aeroplane Works, *2134 Gilbride Rd., Martinsville, NJ 08836.*

The Airplane Factory Inc., *1880 Pineview Rd., Mandeville, LA 70448; (800) 264-7840.*

Thunder Tiger USA Inc., *2430 Lacy Ln. #120, Dallas, TX 75006; (214) 243-8238; fax (214) 243-8255.*

Top Flite, *P.O. Box 9021, Champaign, IL 61826-9021.*

Tower Hobbies, *P.O. Box 9078, Champaign, IL 61826; (800) 637-6050.*

Tru-Turn Racing Products, *3333 Harrison Ave., #5, Riverside, CA 92503; (714) 352-3002.*

UFO; *distributed by Satellite City, P.O. Box 836, Simi Valley, CA 93062.*

Ultracote; *distributed by Carl Goldberg Models (see address above).*

U.S. AirCore, *4576 Claire Chennault, Hangar 7, Dallas, TX 75248.*

Vailly Aviation, *18 Oakdale Ave., Farmingville, NY 11738; (516) 349-2386 (after 6:30 p.m. EST).*

Vinnie Pin Striping, *20 Solice Pl., New Rochelle, NY 10804.*

ViP Publishing Inc., *P.O. Box 16103, Colorado Springs, CO 80909.*

Vinylwrite Custom Lettering, *16043 Tulsa St., Granada Hills, CA 91344.*

WEP; *distributed by Model Electronics Co., 6500 6th Ave. NW, Seattle WA 98117.*

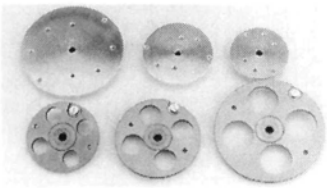
Williams Bros. Inc. *181 Pawnee St., San Marcos, CA 92069.*

YS; *distributed by Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718; (714) 455-9888.*

Zap; *Frank Tiano Enterprises 15300 Estancia Lane, West Palm Beach, FL 33414.*

Zenoah; *distributed by Indy R/C, 10620 N. College Ave., Indianapolis, IN 46280; (317) 846-0766.*

PRODUCT NEWS



HANGAR 9
Servo and Pull/Pull Wheels

These gold-anodized, aluminum servo and pull/pull wheels available for JR, Futaba and Airtronics servos eliminate the flexing that occurs with plastic servo arms and wheels. Servo wheels come in three sizes (30, 35 and 45mm), and feature drilled and tapped 2mm holes at various distances for customized linkage positioning. The pull/pull wheels also come in three sizes (30, 35 and 45mm) and accept up to 0.040-inch-diameter cable. A one-piece cable fits in a groove around the circumference of the wheel and is locked into place with a 2mm screw (provided).

Prices—$9.95 (servo wheels), $14.95 (pull/pull wheels).

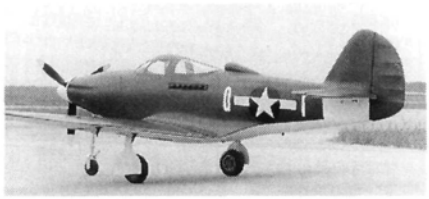
Hangar 9; distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.

Q-WELD COMPANY
Q-Weld™

Q-Weld is a pre-measured, environmentally friendly repair putty. You can mix it with your hand and use it to repair steel, aluminum, chrome, plastic, glass and wood. It sets hard in 5 minutes and can be stored in its resealable tube. It can be sanded, sawed, drilled, tapped, machined and painted. The unmixed putty has a 3-year shelf life.

Price—$5.95/2-ounce tube.

Q-Weld Co., 5230 W. 16th St., Ste. 349, Indianapolis, IN 46224; (800) 995-4314.



DAVE'S CUSTOM MODELS
P-39C Bell Airacobra

Dave's Custom Models adds the P-39C Bell Airacobra to its line of R/C 1/5-scale models. This kit features an epoxy/glass, pinhole-free fuselage; a cowl; a spinner; a canopy; and foam-cores. No wood is included in the kit. Specifications: wingspan—85 inches; fuselage—72 inches; weight—26 to 28 pounds; engine—G-62 or equivalent; radio—6-channel.

Price—$325 (plus $35 S&H).

Dave's Custom Models, 10205 Spring Cir., Austin, TX 78736; (512) 288-2055.

NELSON AIRCRAFT CO.
System Three® Paints

These water-based, linear polyurethane paints are low in toxicity, nonflammable and fuelproof. They dry dust-free in less than 5 minutes, and you can apply a second coat in less than 15 minutes. The paint can be sprayed or brushed on, and you can apply it over polyester fabrics without clear dope. More than 40 colors, including 16 military colors, are available in pintsize containers. A complete information package with a color chart is available from Nelson Aircraft Co. for $1.

Price—$15.95/pint.

Nelson Aircraft Co., 21550 N.W. Nicholas Ct., Unit D, Hillsboro, OR 97124; (513) 629-5277; (503) 629-5817 (fax).

HANGAR 1 AVIATION
F-105 Thunderchief

This semi-scale jet features a foam wing and typical box-and-former fuselage construction, and it includes a hardware package. The engine is mounted in the nose. Specifications: wingspan—33 inches; weight—3.5 to 4 pounds; engine—.35 to .46 2-stroke; radio—4-channel.

Price—$109.95.

Hangar 1 Aviation, 2705 Airport Rd., Ste. 111, Dalton, GA 30721; (706) 278-1585.

SONIC-TRONICS INC.
Super Servo Arm

This new Super Servo Arm is designed for 1/4- and 1/3-scale-type aircraft. It's injection-molded of fiber-composite materials and is very strong and rigid. A complete package contains two each of four types of arms. It's available for Futaba, Airtronics, Hitec, Ace, JR and Cox servos.

Part nos.—340 (Futaba), 341 (Airtronics, Hitec and Ace), 342 (JR and Cox); **prices**—$8.95 each.

Sonic-Tronics Inc., 7865 Mill Rd., Elkins Park, PA 19117; (215) 635-6520, (215) 635-4951 (fax).

Descriptions of products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, nor does it guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**. **Manufacturers!** To have your products featured here, address the press releases to **Model Airplane News,** attention: Product News, 251 Danbury Rd., Wilton, CT 06897.

SIMPLE PROGRAMMING

(Continued from page 127)

detectable Rf interference. This could be combined with data compression techniques in order to increase overall system speed. Such a system could also use currently available frequency-synthesized systems to allow the wireless scanning and selection of a clear channel after checking all available channels for an optimum signal.

John Riggs, *Carmichael, CA*

- **Electronic buddy box.** Electronically link (rather than with a cord), two transmitters together when they are used as a buddy-box system. There is real hazard to being connected mechanically.

I wonder if some of the infrared systems that are so popular in TV remotes would be able to give suitable transfer of information for such a system. *DCB*

Brian Park, *Brighton MA*

- **Single-stick radios revisited.** Bring back single-stick radios by having a special stick assembly (with another pot wired into the stem) that would plug into either the left hand or right hand gimbals of existing transmitter cases. This type of a system would allow ambidextrous use, and it would be economical.
- **In-flight telemetry of data.** This would include a video channel with a cockpit view of the flight.

Imagine viewing this on your radio's display! Well, thanks to all the contributors who sent in ideas, and let's continue to tell the manufacturers what types of radios and features we're looking for. Loops and rolls *DCB*

■

AIRWAVES

(Continued from page 9)

BUILD A BRONCO?

I'm inquiring about plans for the North American OV-10A Bronco. A friend led me in your direction; I hope you can help. How much do the plans cost?

PAUL C. CLARK
Dubuque, Iowa

Paul, plans (no. FSP09681) for the OV-10A, designed by Frank Capan, appeared in the September '68 issue of Model Airplane News. At the time, the model was a consistent winner at scale contests and had very good single-engine performance. By today's scale standards, it's a bit on the simple side, but it's still a good, stable flier. The 68-inch-span model is built using traditional balsa/plywood construction and was designed for two .60 2-stroke engines. The two sheets of plans cost $22 plus $3 S&H.

If that one is too big, stay tuned! A great little Bronco for twin .25s is in the works right now. It has a wingspan of approximately 52 inches. The designer, Rich Uravitch, says that this one flies like a charm and looks just as sinister as the full-size counter-insurgency aircraft. The subject of a future construction article, this model is sure to be a winner on every builder's list. You can order plans for the larger Bronco by calling (800) 243-6685. Good luck with your future project. GY

LAST WORD ON FLOATS?

Please congratulate Dave Windom for an excellent article on floats in the August '94 issue of *Model Airplane News*. As you know, I've probably had more articles on R/C seaplanes and floats published than any other author. Over the years, much misinformation on floats has been published as we grew from the arbitrary rules of thumb to the level of well-proven empirical designs.

The first published, functional, R/C model, flat-bottom, float designs were on my Seasquare GT (AAM 11/74) and Seasquare (MB 3/76). The latter first flew around 1973. It was a "Skunk Works" project that worked so well that it was soon demonstrated for all to see. The GT version was a derivative that flew pattern-type maneuvers very well. Ken Willard and others soon followed. They learned, as Dave Windom says, that "They're easier to build (and) they get up on the step faster."

The essentials of model float/hull design are simple: make them big enough to float the model, put the step approximately under the CG, provide for 5 to 7 degrees of rotation for takeoff and use a strong mount to eliminate gear flexing.

Dave's float design provides all the essentials and goes on to provide very fine construction techniques. His design is definitive, in my opinion.

GEORGE WILSON
Marstons Mills, MA

CLASSIFIEDS

RATES: non-commercial—25 cents per word. No charge for name and address (no commercial ads of any kind accepted at this rate); commercial— 50 cents per word (applies to retailers, manufacturers, etc.); count all initials, numbers, name and address, city, state, zip code and phone number. **All ads must be paid for in advance.** To run your ad for more than one month, multiply your payment by the number of months you want it to run. Deadline: the 10th day of the month, 3 months in advance, e.g., *January 10 for the April issue.* We don't furnish box numbers, and it isn't our policy to send tear sheets. **SEND AD AND PAYMENT TO: CLASSIFIED ADS, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.**

R/C WORLD ORLANDO, FL, CONDO RENTAL: 2 bedroom, furnished. Available weekly or monthly. Low rates. 100-acre flying field with enclosed hangars. Close to Disney World and Epcot Center. For information, please call or write to R/C World, 1302 Stearman Ct., Orlando, FL 32825; (407) 380-6359.

SALE—kits: wood, plastic; ignition engines; parts and mags (pre-1965). Specify needs. Send SASE and 60 cents for list. Leonard Roberts, 3819 Lydon Ln., Moosic, PA 18507; (717) 961-2357. [12/94]

WANTED: built or partially built Ercoupes, Cessna 150, 152, 172, 182, Grumman American Tiger (AA5), American Yankee (AA1), or Mooney M-10 Cadet. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585. [5/95]

PLANS ENLARGED. Scanning/plotting services; model designer's computer software; free information. Concept, P.O. Box 669E, Poway, CA 92074-0669; (619) 486-2464.

MAKE REAL DECALS with your computer and printer! Send $10 for starter kit and instructions to LABCO, 27563 Dover, Warren, MI 48093-4764. [5/95]

ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $3 for huge list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537. [5/95]

MODEL MOTORS WANTED—Most types, 1970 and earlier. Cash or trade. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [3/95]

ANTIQUE IGNITION engine parts: excellent reproductions, fuel tanks, points, timers, coils, needle valves, gaskets, etc. Champion spark plugs. Catalogue—$5 (intl. airmail—$7). Aero-Electric, 1301 W. Lafayette St., Sturgis, MI 49091. [2/95]

WANTED: ignition model engines 1930s to 1950s, especially Elf, Baby Cyclone, Brown Jr., Ohlsson Custom and Gold Seal. Also model racecars, any parts, spark plugs, etc.; Woody Bartelt, 1301 W. Lafayette St., Sturgis, MI 49091; (616) 665-9693, or (800) 982-5464. [2/95]

SCALE DOCUMENTATION and resource guide. Larger, updated 1994 Edition. World's largest commercial aircraft collection. Over 5,000 different color FOTO-PAAKS and 25,000 three-view drawings; 152-page resource guide/catalogue—$6 (Canada—$7; foreign—$12). Bob Banka's Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [2/95]

GERMAN AIRCRAFT WW II—handbooks, service part lists, instruction manuals. List—$2. Udo E Hafner, Eugen-Bolz-Str. 15, D-71636 Ludwigsburg, Germany. [5/95]

WW I PLANS—Peanut to 100 inches. Send $2 for illustrated catalogue to Clark Smiley, 23 Riverbend Rd., Newmarket, NH 03857. [3/95]

FLY DAVE BROWN SIMULATOR. Use your transmitter. Works with Futaba, JR, Airtronics, Hitec. Uses standard joystick connection. For more info, contact Computer Designs, 8530 N. Montana Ave., Helena, MT 59601; (406) 458-9416. [1/95]

OLD MODEL MAGAZINES. SASE for list. Dave Bessel, P.O. Box 669, Poway, CA 92074.

JET ENGINES—pulsejets, Jet-X, Turbonique. Monthly newsletter $17/yr; $25 international; single issue $2. Catalogue $5. DOYLEJET, P.O. Box 60311-A, Houston, TX 77205; (713) 443-3409. [12/94]

ULTRALIGHT AIRCRAFT. New publication has plenty of information, pictures and stories on this exciting flying sport. Buy, sell, trade and kit-built aircraft. You can learn to fly the real thing. Fixed wing, powered parachutes, rotor, balloons and blimps. Sample issue $3. Annual subscription $36. Introductory offer of only $24. "Ultraflight Magazine," 12545 70th St. N., Largo, FL 34643-3025. [12/94]

AIRSHIPS (MAN): Technical, history, tapes, collectibles. 522 E. Vine, Box 213, W. Covina, CA 91790. [2/95]

MODEL GRAPHICS/VINYL LETTERING. Introducing new 20-page instructional catalogue and model decorating guide. Special offer: any combination of 10, 2-inch letters or numbers, custom-cut and ready to install, with catalogue—$4.95. Graphics A.M.P. Inc., 42a Nancy St., W. Babylon, NY 11704; (516) 253-2702. [2/95]

WANTED TO BUY—Kraft single-stick systems. Good prices. For information, write or call Luis A. Barranco, M.D., P.O. Box 7682, Ponce, P.R.; (809) 842-7325. [12/94]

R/C SKYDIVING—illustrated catalogue: $1. R/C Skydivers, Box 662N, St. Croix Falls, WI 54024. [2/95]

ANTIQUE IGNITION-GLOW PARTS CATALOGUE, ½-inch thick, timers, needle valves, cylinder heads, pistons, points, tanks, spark plugs, racecar parts. Engines: ½As, Baby Cyclones, McCoys, Phantoms, etc. $8 postpaid (U.S.); $20 foreign, Chris Rossbach, R.D. 1, Queensboro Manor, Box 390, Gloversville, N.Y. 12078. [2/95]

SODA-CAN AIRPLANES—replica biplane detail plans with photos: $7.50 PPD. Early's Craft, 15069 Valley Blvd. SP 26, Fontana, CA 92335. [8/95]

CARS. Selling model collection, 1973 issues up, 1/24-1/25, individual prices, about 800. Ralph, Box 2423-P, Yakima, WA; (509) 965-0670. [5/95]

1995 ANTIQUE model airplane engine calendar—$10. Allow 8 weeks for delivery. Alan Mironer, 269 Concord Rd., Bedford, MA 01730. [1/95]

"REPRODUCE ALMOST ANYTHING": plastic, metal, rubber, plaster, ceramic parts; 40-minute "Basic Silicone Mold Making" videotape shows simple, step-by-step techniques used by movie model makers. A 44-page manual expands on the videotape and includes a nationwide source list of materials—a must for the serious hobbyist. Make better models and/or greater profits. $39.95 plus $3.50 S&H. California residents add $3.30 sales tax. Cherokee Accessories, 4127 Bay St., Ste. 226 M, Fremont, CA 94538. [2/95]

DO YOU SPEAK MODEL AIRPLANE? Seventy years of aeromodeling history! All the heroes, contests, models! Paperback, 320 pages, $19.95 postpaid. Also: Old Buzzard's Soaring Book, $16.95. Dave Thornburg, 5 Monticello, Albuquerque, NM 87123; (505) 299-8749 for Visa/MC. [12/94]

NEW ZEALAND AERO PRODUCTS. Scale plans: Agwagon, Pawnee, Pawnee Brave, Airtruk/Skyfarmer, Fletcher FU-24, Aerobat, Hall's Springfield Bulldog, Typhoon, DC-3/C-47, Fairchild PT-19/Fleet PT-26, RNZAF CT-4B Airtrainer/CT-4C Turbine Airtrainer and more. Fiberglass parts, hardware packs, color photo packs available. Free documentation with plans. Catalogue/price list (USD)—$5; Visa/MC. 34 Ward Parade, Stirling Point, Bluff, New Zealand; (03)2128192.

GIANT SCALE PLANS–drafted by Warren P. Russel of New Zealand. Send SASE to Alaska Aero Products, P.O. Box 5003, Nikolaevsk, AK 99556-5003. [1/95]

SWOOSHIE BAILS OUT! Release a scale-like parachutist! A real crowd-pleaser and a lot of fun! For a brochure, send SASE to Hobby Hut Mfg., 2020 W. 21st N. Ste. #77, Wichita, KS 67203-2107, Dept. MAN. [4/95]

CASH FOR TOY metal, outboard boat motors: Oliver, Mercury, Gale, Johnson, Evinrude Sea-Fry Twin, Scott. Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49686; (616) 941-2111. [12/94]

WANTED: Old kits and plans of R/C models from the '50s, '60s and '70s—especially Goldberg, Jetco, Top Flite, Sterling and Midwest kits or plans. Willing to pay for duplication of plans. Call Gene (214) 494-0323. [2/95]

FREE INFORMATION! Allow the government to finance your hobby, small business. Loans/grants to $67,900. Call 24-hour, free recorded message: (810) 825-6700, Dept. 1492. [12/94]

WANTED: Model engines and racecars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [10/95]

R/C HELICOPTER TRAINING COURSE. One-on-one personalized instruction with your equipment or ours. Three-day course located at beachside resort community in sunny Florida. Call (904) 441-0347 (evenings). [1/95]

FOR SALE: Quadra 42 CDI (new)—$175. Modeltech Dragon Lady BHP kit—$125. PAW .49 Diesel (new)—$125. George Fisher, 2305 Birch St., Van Buren, AR 72956; (501) 474-8402. [12/94]

GEE BEE plans utilized for Benjamin's full-scale R-2. Eicher/Kimball "Z"; Jenkins' "Bulldog." 1/3, 1/4, 1/6 through 1/24 scale. 10 airplanes. Shirts! Plans! Catalogue/news–$4, refundable. Vern Clements, 308 Palo Alto, Caldwell, ID 83605; (208) 459-7608 [1/95]

EZ KITS WANTED—and 40-size EZ Warbirds. Cash or trade for O.S. engines. Will pay shipping. Pat Williams, 2125 Forrest Lake Dr., Cincinnati, OH 45244; (513) 474-1559. [1/95]

FOUR BIG SCALE CATALOGUES SPPS—180 super-scale; SPPS—130,000 documentation photos, three-views; Argus Scale Plans Handbook; Argus three-view scale drawings—the best! $5 each, USA, Canada. Add $5 each for overseas airmail. Send SASE for plans list and enlarging prices; Visa, MasterCard. Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; phone/fax (910) 292-5239. [12/94]

WANTED: Old wooden kits, magazines, WW II IDs and Mfgrs. models. Bill Fornwalt, 103 Dartmouth Ave., Johnstown, PA 15905. [2/95]

MAGAZINE BACK ISSUES—*American Modeler, American Aircraft Modeler, Aeromodeller, Model Airplane News, Model Aircraft, RCM* and more; 1930s–1990s. For list, send SASE to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [3/95]

INTERNATIONAL AIRCRAFT RESEARCH. Need documentation? Include name of aircraft for availability of documentation, with $3 for photo and three-view catalogue. 1447 Helm Ct., Mississauga, Ontario, Canada L5J 3G3. [12/94]

R/C SAILPLANES—scale, sport, electric. SAM and NFFS powered, towline, Wakefield. F/F scale and sport powered, rubber, towline. Formerly B2 Streamlines Plans Service. Catalogue $2—all models illustrated. Cirrus Aviation, P.O. Box 7093, Depot 4, Victoria, BC, Canada V9B 4Z2. [12/94]

WANTED: OLD, ready-to-run, gas-powered cars, airplanes and boats. Complete or parts. Please write: Dean Barham, 4032 Iowa St., San Diego, CA 92104; (619) 528-1680. [3/95]

SCRATCH-BUILDER'S ALMANAC—all kinds of plans: R/C, FF, CL, scale (up to 1/3), vintage R/C, old-timers, nostalgia, gliders, boats; for rubber, gas, electric, thermals! Bill Northrop's Big John, Gipsy Moth, Apprentice, Travel Air 2000, etc. For postpaid illustrated catalogue, send $1 to Bill Northrop, 2019 Doral Ct., Henderson, NV 89104. [12/94]

R/C SKYDIVERS—plans, kits, jump planes, etc. Illustrated catalogue—$1. R/C Skydivers, Box 662A, St. Croix Falls, WI 54024. [12/94]

MOLD-MAKING/CASTING GUIDEBOOKS—complete techniques and sources of rubbers, plastics, resins, metals and more. For information, contact Castech-MA, Box 16586, Memphis, TN 38186-0586. [3/95]

KIT CUTTING. Will custom-cut any kit to your specifications—your plans or mine. Guaranteed quality like no other. Please write for quotes, or to inquire: 43940 Yorktown, Canton, MI 48188. [12/94]

YELLOW AIRCRAFT, Blue Angel no. 6, twin O.S. 91s; dual in-flights; variable-geometry chrome cones; brakes, etc. Asking price: $10,000. Two other paint schemes to choose from. Call for prices. Bob Fiorenze (407) 327-6353. [12/94]

DRAWINGS ACCURATELY enlarged and copied. Any scale; any size; three-views; magazine plans; old-timers; antiques. Money-back guarantee. Send $2 for info. Roland Friestad, 221 MAN 155th St., Cameron, IL 61423. [5/95]

WANTED: S.T. 46 engines or parts—R/C or U/C; cash or trade. Kenneth A. Jones, 10669 Cardigan St., El Paso, TX 79935; (915) 592-3939. [12/94]

WANTED: S.T. 60—new or used, but decent; R/C or U/C; cash or trade. Kenneth A. Jones, 10669 Cardigan St., El Paso, TX 79935; (915) 592-3939. [12/94]

WANTED: early O.S. FT-120 Gemini crankshaft, part no. 46002005. Earl Colley, 202 Fair Park Ave., Henderson, TX; (903) 657-3605. [3/95]

OLD-TIME ENGINES, kits and plans. Send SAE and 50 cents for list. T. Alden, 2660 Balaclava St., Vancouver, B.C., Canada V6K 4E2. [1/95]

DEBOLT PLANS—radio-control, free-flight, control-line. Send separate SASE for each list to Fran Ptaszkiewicz, 23 Marlee Dr., Tonawanda, NY 14150-4321. [3/95]

TOY METAL OUTBOARD boat motors wanted: Gale, Mercury, Oliver, Sea-Fury Twin, Johnson, Evinrude SuperTigre also wooden boats, steam engines, thimble drone metal racecars. Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49686; (616) 941-2111. [12/94]

SELL: O.S. 48FS NIB—$185; Y.S. 45FS NIB—$125; Futaba 5UAP, excellent condition—$175. Call Mike at (814) 835-2044. [12/94]

WANTED: FUTABA single-stick system; whole system or transmitter. Bob Vomero (814) 825-8484. [1/95]

PLANS TO BUILD more than 700 tools, machines and accessories for your shop. Catalogue—$1. Wood-Met, Dept. MAN, 3314 W. Shoff Cir., Peoria, IL 61604-5964. [3/95]

AERO FX by Jo Designs: exact-scale, computer-cut, high-performance vinyl graphics and paint masks. Lettering; nose art; insignia for scale, pattern, pylon and sport fliers; complete graphic sets available. Call or write for free sample and catalogue. Jo Designs, Rt. 1, Box 225AA, Stratford, OK 74872; (405) 759-3333. [2/95]

KITS WANTED: Guillow's discontinued WW and 100 series World War I balsa-wood airplane kits with 18-inch wingspan; Hawk, Maircraft, and other solid-balsa kits; any discontinued balsa kits, including California Models, Megow, Ace-Whitman, Cleveland, Monogram Speedee-Bilts, etc.; Hudson Miniatures wooden car model kits. Collector will pay top prices. George J. Santikian, 7285 N. Channing, Fresno, CA 93711; (209) 439-3363. [12/94]

REPLICA SWISS WATCHES: 18kt.-gold-plated! Lowest prices! 2-year warranty! Heavyweight! Divers and chronographs...! Call (404) 682-0609; fax (404) 682-1710. [12/94]

CASH FOR ENGINES: ignition, glow, diesel—all types; any condition; sale list, too! Estates my specialty! Send SASE for list. Bob Boumstein, 10970 Marcy Plaza, Omaha, NE 68154; (402) 334-0122. [5/95]

PAPER MODELS—1:24-scale kits printed on card stock with detailed instructions. These make attractive, realistic display models. Cub, Taylorcraft, Aeronca Champ, Aeronca C-3—$7 each, postpaid, first class; Focke-Wulf Stieglitz biplane—$9. NYS residents, please add sales tax. Robert Kaelin, 1099 Ostrander Ave., Riverhead, NY 11901. [1/95]

MODEL BOATS: buy, sell, trade, search, restore, or custom-build. Bob Langert, 2350 250th St., Space #30, Lomita, CA 90717; (310) 326-9106. [5/95]

"EIGHT GREAT AIRPLANES You Can Make with a Pencil and Index Cards"—booklet. Send $5 to Watershed Publishing, Dept. MAN, 1812 Brookter St., Slidell, LA 70461. [2/95]

COLOR PHOTO PACS by David Boddington, UK; 6x4; over 500 available. Scale drawings from ASP UK and Fred Spring, Australia. Send SAE for lists, Best in Scale catalogue—$6. Bob Holman, Dept. MAN, Box 741, San Bernardino, CA 92402; (909) 885-3959; fax (909) 885-9307. [12/94]

FLIGHTSMITH R/C MAGAZINE: high-quality writing; limited advertising. $14.95/year. FlightSmith, P.O. Box 59905, Chicago, IL 60659; (312) 283-8181. [2/95]

R/C FLIERS' DREAM COME TRUE: vacation with your family, and take your R/C plane! R/C World is a radio-control community with beautifully furnished condo (pool, tennis included), and one of the world's finest flying sites. All this only 20 to 30 minutes from Disney, Epcot, Universal Studios, Seaworld, and about 1 hour from Kennedy Space Center. For more information, call or write: Dave Patrick, P.O. Box 1385, Oak Park, IL 60304; (708) 771-6697. [12/94]

WANTED—PLANS. Will pay premium for plans or built-up model of Lockeed Orion. Any scale accepted. Bob Gordon, Ste. 12D, 350 Grovers Ave., Bridgeport, CT 06605; (203) 334-2222. [12/94]

HISTORIC REPLICAS: Flying Tigers, 94th Aero, Lafayette Escadrille accessories, pilot sport shirts, T-shirts, wings, medals, beer steins, scarves; WW I squadron pins—from $4.95. Free gift with order. Catalogue—$1 (refundable). Company of Eagles, 875A Island Dr., Ste. 322N, Alameda, CA 94502. [3/94]

WANTED: Graupner Cirrus—whole fuselage or plans. Todd Presley, 3803 Kaimuki Ave., Honolulu, HI 96816; (818) 732-1432. [1/95]

HELICOPTERS FOR SALE—Three; used. Schluter Futura helicopter and engine—$300; Schluter Heli-Star—$50; MFA Sport 500 with Hughes 500 fuselage (no engine or radio)—$50. Allan Slattery, 426 Fairmount Ave., Jersey City, NJ 07306; (201) 332-2803 [2/95]

PHOTOVOLTAIC SOLAR PANELS charge batteries anywhere. 50 solar products, $5 catalog send check/money order to Sunix Co., P.O. Box 3889-MP, San Rafael, CA 94912-3889, dealer inquiries (415) 924-6160. [2/95]

ADVERTISER INDEX

FINAL APPROACH

AN R/C BIRD OF A DIFFERENT FEATHER

Freewing Aerial Robotics Corporation's 16.8-foot-span Scorpion is the latest successor to the SuperTigre .90-powered, proof-of-concept model we featured in the editorial in the July '93 *Model Airplane News*. Developed by Maryland-based Freewing in conjunction with Burt Rutan, this radically designed, unmanned aerial vehicle (UAV) has a top cruise speed of 180mph and a nominal service ceiling of 10,000 feet. Its 360-pound all-up weight includes a 50-pound payload. Currently powered by a Rotax 503 engine, it will later be propelled by a derivative of the Norton rotary engine running on JP-8 or diesel fuel.

The Scorpion is configured for slow flight. The quad landing gear facilitates fuselage rotation during ground handling. The fuselage flattens out in line with the tail booms for cruising.

But the really interesting news—and there's more to this than we have previously reported—is how this unusual aircraft flies. As readers may recall, the main wing is mounted on pivots that are oriented along the wing's CG. This permits the wing to swing or pivot in the pitch axis, independent of the tail booms and fuselage body. Yielding to turbulent air (e.g., the wing's leading edge momentarily pitches up or down in response to a gust) allows the wing to absorb energy that would otherwise be transmitted to the fuselage; hence the design offers a very stable platform in flight for a variety of sensors. Similarly, where target illumination or other functions would require gyro stabilization, the stabilizing gear can be lighter and smaller.

Scaled Composites employees prepare to fly the Scorpion. Two R/C transmitters are used: a ballistic recovery parachute and engine kill switch are separately controlled by a safety officer.

The aircraft can also raise its nose to vector thrust downward. This allows the aircraft to fly as slowly as 20 percent of stall speed, which, in turn, permits short, steep takeoffs and landings in tight confines.

CG SURPRISE

How a Freewing aircraft actually flies is startling and thought-provoking. Because the main wing is hinged, there's no transmission of torque between the fuselage and main wing in the pitch axis. The center of pressure (lift) lies just behind the hinge point, giving the wing a negative pitching moment. A reflexed airfoil (the trailing edge has a slightly upward contour) imparts a positive pitching moment, and the result is a stabilized wing—one that is aerodynamically in trim—that wants to weathervane into the relative wind and fly through the air like a flying wing.

But what if the CG moves aft? On nearly any fixed-wing aircraft, the CG can't move aft more than 10 percent of the chord without the aircraft progressively moving toward dangerous instability. With the Freewing, the penalty of an aft CG is increased drag. Longitudinal stability simply isn't affected!

Imagine a tail-heavy fuselage trying to swing down on the Freewing's hinge; the tail group has the task of lifting the fuselage back up into flying trim. The farther aft the CG, the greater the lift needed. The limiting factor in terms of how far back the CG can shift is thus the size of the tail wings. And as the tail groups' lift increases, so does the induced drag. The main wing itself continues to fly on its own, quite oblivious to the CG location, under flying-wing-style elevon control.

The Scorpion is being offered for the U.S. Army missile command's close-range/maneuver-variant UAV competition. It has also attracted the interest of France's Matra Defense, which is sponsoring the development of a version for possible use on French warships. Interested parties can obtain more information on this new bird from Freewing Aerial Robotics Corp., University of Maryland, Bldg. 340, College Park, MD 20742. Even as this design is further refined for UAV markets, we are hoping to publish a sport R/C version of it; keep your eyes on future issues of *Model Airplane News*.

—Tom Atwood